

SECOND EDITION

The ROWAN
PREMIUM BONUS
SYSTEM
of
PAYMENT BY RESULTS

BY
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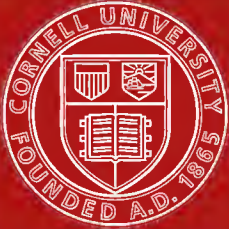
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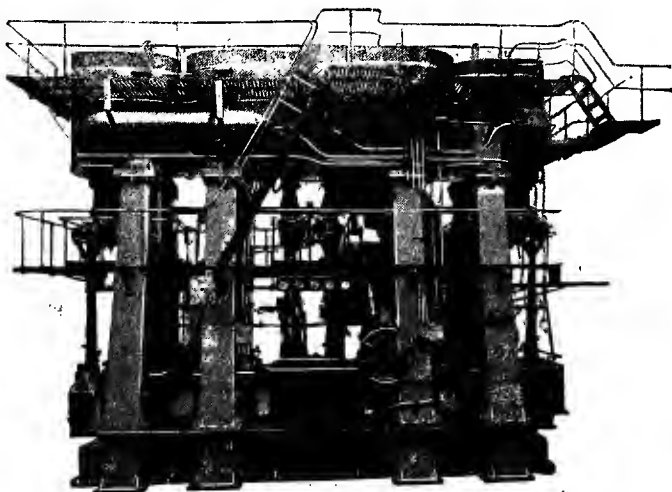
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THAT IT WILL HELP TOWARDS THE
SOLUTION OF THE DIFFICULT
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IT DEALS

SECOND EDITION

The Premium Bonus System :

A Scheme for Stimulating and
Increasing the Productive
Capacity of Industrial
Resources

William By
Sir W. Rowan Thomson, *Wh. Sch.*

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CONTENTS

TABLES.	CHAPTER.		PAGE.
—	I.	Introductory, - - - - -	7
I	II.	Increased Output and Rate Revision, -	11
—	III.	Increased Output under Premium Bonus,	15
2-3-4 } 5-6-7 }	IV.	Premium Bonus Systems, - - -	19
—	V.	The Basis of Comparison, - - -	30
8-9	VI.	The Fixing of a Time Allowance, - -	33
10-11	VII.	The Division of Bonus, - - - -	42
—	VIII.	The Choice of a System, - - -	52
12-13 } 14 }	IX.	Effects of the System, - - - -	58
15-16 } 17-18 } 19 }	X.	Hints on Practical Application, - -	66
—	XI.	Conclusion, - - - - -	79
20-21 } 22 }		Appendix—Rowan General System, -	85

LIST OF TABLES

CHAPTER.	TABLES.		PAGE
I.	—		
II.	I	Average Premium earned in Machine Shop 1899/1913 inclusive, - - -	12
III.	—		
IV.	2	Definitions, - - - - -	19
	3	Halsey System Table, - - - - -	21
	4	Rowan System Table, - - - - -	22
	5	Rowan, Halsey, and Piecework Cost Curves, - - - - -	23
	6	Rowan, Halsey, and Piecework Bonus Curves, - - - - -	25
	7	Rowan, Halsey, and Piecework Time Rate Curves, - - - - -	27
V.	—		
VI.	8	Standard Time Allowances—Examples with 5% increase, - - - - -	36
	9	Fixed Time Taken—Examples with vary- ing Time Allowances, - - - - -	38
VII.	10	Machinist Results for 1909, - - - - -	45
	11	Results of 7 Oldest Machinists, 1909, - - - - -	45
VIII.	—		
IX.	12	Wages earned under Premium Bonus, 1913 and 1916, - - - - -	59
	13	Effect of Alteration in Position of Three Machines, - - - - -	61
	14	Examples of Time Saved on certain Jobs, - - - - -	64
X.	15	Premium Bonus—David Rowan & Co.'s 1898 Conditions of Agreement, - - - - -	67
	16	Data Book—Sample Page, - - - - -	70
	17	Individual Line—Sample of, - - - - -	72
	18	Wages Book—Sample Page, - - - - -	74
	19	Squad Line—Sample of, - - - - -	76
XI.	—		
Appendix	20	Rowan General System—Bonus Curves, - - - - -	88
	21	Do. do. Cost Curves, - - - - -	90
	22	Do. do. Rate Curves, - - - - -	92

Chapter I

INTRODUCTORY

This country has at last awakened to the fact that, if it is to maintain its position as a great producing nation in the world-wide competition which, it is admitted on all sides, is certain to take place on the termination of hostilities, some means must be found of stimulating and increasing the productive capacity of our industrial resources; of increasing the rate of output which has hitherto been prevalent under the ordinary hourly rate of payment. However satisfactory the hourly rate of payment, or time rate of working—to use a better expression—may have been in the past, very little can, under modern conditions, be said in its favour.

In presenting the following observations upon what the writer regards as a practical means of meeting the demand referred to, it may, at the outset, be contended that the question has been looked at entirely from the point of view of an employer. The answer is two-fold—(1) that, while the writer does not disclaim the position he at present holds, that of an employer, he has personally gone through each stage of employment in the Engineering Industry, from apprenticeship upwards, and in doing so, has become intimately acquainted with the point of view of an employee, and (2), in these pages an honest effort has been made to set forth his views without bias, and to hold the balance justly and evenly between interests, which may on the surface appear to be conflicting, but which on deeper investigation will be found to be identical,—the interests of employer and employed.

The growth of industrialism has brought into being a powerful Trade Unionism whose influence has been mainly directed to the establishment of what is a minimum time rate per hour for its members. That minimum has come to be regarded as the standard rate, and, as a direct consequence, practically the maximum rate per hour; so

that in any given district all workers belonging to the same Union, whatever may be their individual abilities—good, bad, or indifferent—are paid at the same rate of wages per hour, regardless of the respective amounts of work done. One of the chief objections, indeed, taken by Trade Unions to any system of payment by result has been that it revealed the varying capabilities of individual workmen and struck at the root of the doctrine of the equality of the brethren. Another and less well-reasoned objection has been that the increased production accruing from a system of Payment by Result operated towards creating a greater measure of unemployment.

Owing to the influence of a more general appreciation of some of the facts of economics, we do not now-a-days have these objections so prominently brought forward. It is fortunate that a new point of view has been reached. The total lack of incentive under the Time system of working and its unfairness to the better class of workman is now fully appreciated. The stress of warfare has shown what serious consequences arise from a system under which the good workman, being paid at the same hourly rate as his less capable neighbour, quite naturally declines to do more work than that neighbour, with the result that output suffers and the tendency is steadily towards the level of the least efficient.

At a time, therefore, when output is so essential, Payment by Results has attained a new significance, and now the principal objection which one hears advanced by the Trade Unions is that, when output has in due course been speeded up, the price or the Time Allowances may be "cut" (*i.e.*, reduced) by the employer, until the worker is turning out a greatly increased quantity of work, without a commensurate increase in his wages.

Now, any system of Payment by Results, to be permanently effective and successful, should have the following characteristics:—

- (a) It must, of course, operate to increase the rate of output, not only without increasing the labour cost, but by actually reducing it.

This from the national point of view.

- (b) The reward to the man must be in accordance and commensurate with such increased rate of production.

This from the workman's point of view.

- (c) It should be capable of quick, easy, and safe introduction and operation.

This from the employer's point of view.

There are already in existence many systems of Payment by Results; some of them of a very involved and complex nature, and suitable only for very special or pure repetition work. For Engineering and Shipyard Trades and the general run of industrial occupations there are, however, practically three principal systems actually in operation.

These are:—

- (1) THE PIECEWORK SYSTEM.
- (2) THE HALSEY PREMIUM BONUS SYSTEM.
- (3) THE ROWAN PREMIUM BONUS SYSTEM.

Under the Piecework System, the worker receives a definite price for a definite amount of work, while, under the Premium Bonus Systems he receives a definite bonus based on the time he saves off the time which has been allowed for completing the job (*i.e.*, the "Time Allowance").

Provided the basis of comparison is equitably fixed, each of these three systems will undoubtedly operate to increase the time rate of production, without increasing the labour cost, and each will, at the same time, reward the workman for his increased rate of production. But they vary materially in that respect. To a still greater extent do they vary in regard to the speed, the ease, and the safety with which they can be introduced. By "safety" is meant protection to both employer and employed from unfair consequences, when by oversight or other cause an inequitable price or time allowance has been set. This is a most important feature, and one which will bulk very largely when the employer comes to consider the choice of a system, as although Time Allowances may in obvious cases be increased they should never be decreased, if the confidence of the workman is to be retained.

Premium Bonus Systems have an elasticity in the settlement of Time Allowances, and they are much more easily and quickly installed and put into full operation than piecework. In addition—and very important from the workman's point of view—they offer little temptation to the employer to "cut" prices.

Any system which, if not altogether eliminating this temptation to cut, at least reduces it to a minimum, has claims upon the attention and consideration of workmen and employers alike, which are worthy of the closest examination.

It is necessary, however, to distinguish clearly between rate cutting and rate revision.

For example, Piecework is a system in which money values have always been the terms of its expression. Every piecework price should be the money value of the hours under time rate required for its execution. In other words, it should be the product of A , the actual number of the hours required under ordinary time conditions, multiplied by the standard hourly rate of wages R ,—or $A \times R$. A is a fixed quantity—it is a matter of absolute fact. R is also a fixed quantity for the time being, as it is determined by the conditions of the labour market. Either to enlarge A or to put a fictitious value on R is to set up a false standard, and as such is very properly subject to "Revision." If the value of $A \times R$ is really the product of the actual hours required under time conditions by the standard hourly time rate, then any attempt to reduce this value is "Cutting." It may be that the piece price $A \times R$ thus made up, considered as a wages value in itself, is too small, then the fault lies with R the hourly time rate and not with A .

Chapter II

INCREASED OUTPUT AND RATE REVISION

It is remarkable that the opinion should be so widely held that the increase of output which results from a saving of time arises solely from, and is due to, the workman's own unaided efforts alone—and that the employer has had no part whatever in the process. If a workman has been giving an honest output under time work, it is, speaking generally, a practical impossibility for him, by extra effort and without any assistance from the management, to double his output continuously and still more impossible to quadruple or even treble it.

If in actual practice a workman, when working on Time, had been in the habit of taking a certain time to do a certain job, and he, when transferred to Piecework or Premium Bonus, does, and continues to do, that same work in less than half, say, one-third or one-fourth, of his former time, only one of two conclusions is possible: either that the man, when working on Time, had not been giving the rate of output which he should have done—that is, he had not been giving a fair day's output for his day's pay—or, alternatively, he has received very special help and assistance from the employer to be able to so reduce the time.

It should be obvious that, if under the average time rate of working a fair day's output is given for the standard rate of wages, there must be a physical and practical limit to the amount of time which can be saved over the ordinary time rate of working, and, therefore, a limit to the increased output arising therefrom.

To what extent, then, can a workman speed up his ordinary time rate of working, increase his output, and maintain same, without injury to his physical or mental conditions ?

As a matter of engineering workshop practice, it is practically impossible to dissociate and separately assess the respective values of

the two factors which contribute to increased output—(1) The man's own and absolutely unaided efforts; and (2) the assistance given by the employer in providing additional handling facilities, small tools, more power, improved lighting, better supply of material, better organization, etc.—short of new and improved machine tools.

For myself, I have arrived at the definite conclusion as regards Marine Engine work, that, with proper time setting, based upon the former time rate basis of a fair day's output, the saving which can be effected under the joint efforts of the workman in economizing his time and energy, and of the employer in assisting him with ordinary additional facilities, will, generally speaking, seldom exceed 50% of a correct Time Allowance, or double output. Of course, much more than this can be done by special and improved new machinery and plant, but then the conditions are entirely changed and the job becomes a new and different one altogether, with a readjusted Time Allowance.

TABLE 1.

ROWAN PREMIUM BONUS SYSTEM

**Average Premium earned in Machine Shop,
1899-1913 inclusive**

Year.	Average Premium whole Dept. Per Cent.	Percentage of Men who made	
		Over 40%	Over 50%
1899	20	No details available	No details available
1900	23		
1901	31		
1902	37	20	2
1903	38	29	3
1904	39	30	9
1905	41	48	17
1906	43	52	16
1907	43	55	25
1908	39	52	8
1909	42	54	17
1910	42	62	29
1911	37	40	9
1912	43	67	22
1913	42	66	19
		Average=	14.6

I base my opinion from data acquired during a long and successful experience of the Rowan System, some results of which are set forth in Table 1, which shews, for a series of the fifteen years prior to the outbreak of war, the average premiums earned by all our machinists.

I have confined myself to the machine shop, because there each man is a complete unit in himself; his operations are not affected in any way by the actions of any of his fellow-workmen, as is the case in squad or gang work, and the results are, therefore, free from the uncertainty which is always present in co-operative working.

From an inspection of the table, it will be seen that in any year during the period the maximum number of workmen who exceeded 50% saving was 29%, while, on an average of the last twelve years only 14.6% of the men exceeded 50% saving; the remaining 85.4% of the men making 50% saving, and under.

Now, the Time Allowances upon which these results were based were those times which had been the use and wont under former time rate conditions, and were never cut from the time they were once set. No matter how often a job was repeated, the original Time Allowance was rigidly and strictly adhered to, and never altered, except where it was clearly shown to have been originally too low, when it was immediately and cheerfully raised; or when the method or means of manufacture was altered.

The introduction of a new machine comes under the latter category, and always involved a re-consideration, but not necessarily an alteration, of the Time Allowance. Occasionally a new machine was installed, on account of its greater accuracy, although it did not do the work any more speedily. In such a case, the Time Allowance remained unaltered. Only when a new machine was introduced which could do the job more quickly was the Time Allowance altered; and, in such reduction as was made, care was always taken that the man could make not only the same bonus as before, but, if anything, slightly more—just to show him that we were not only scrupulously mindful of his rights, but willing and desirous to give him a share of the benefit. It is probably for this reason, and also because many of the Time Allowances originally leaned to the generous side, and were

never reduced, that the proportion of men who exceeded 50% saving, is as high as 14.6 %.

Because of this, and other corroborative evidence of a similar nature, I am of opinion that, with correct time setting, *i.e.*, based upon a fair time rate of working, it is, as a rule, unlikely that in general work, even with all the additional ordinary helps which the employer can give, the saving in time will exceed 50% all round.

I admit at once—I have examples in my own experience—that by making a special effort a man can considerably exceed this, but these are special spurts, and as such cannot be sustained without physical detriment to the workman.

These, however, are special and isolated cases, and if this limit of 50% saving actually exists, and I believe it does, as regards all except pure repetition work, then, when the average saving goes much beyond this, there can be only one conclusion, *viz.*, that the original times were set too high, whatever the cause may have been.

Chapter III

INCREASED OUTPUT UNDER PREMIUM BONUS

I have referred to the impression which exists in certain quarters that the increase of output which results from a saving of time, arises solely from, and is due to, the workman's own unaided efforts alone—that the employer has had no part whatever in the process. Certainly as regards Premium Bonus in actual practice, quite the contrary is the case—the employer does have a share, and a very considerable one at that, in procuring the resultant saving. In so far, therefore, as the employer has contributed to the increased output he is entitled to some return.

It may be that, as regards Premium Bonus, the impression has arisen from what is seen and abundantly evident, viz., the saving in time; but what is not seen, or, at any rate, is apt to be ignored by the workmen, is the effect which the co-operation of the employer has in helping towards that saving, by providing additional ordinary facilities which the workman either does not notice, or, if he does, he fails to appreciate at their full value and significance, until he has actually experienced them.

In connection with Piecework, however, that impression does not prevail to the same extent, for it is a matter of common experience that disputes are of frequent occurrence as to what reduction on the piece price should be made, when any additional facilities helping towards increased output are proposed to be introduced. There, it is quite apparent what extra help the employer is bringing towards the increased output, and naturally he, being the one who pays for it, desires to have some adequate return on his additional expenditure and effort. This, under a Piecework System, he can only get by a reduction in the piece price. Under a Premium Bonus System, unless these additional facilities were of a fairly definite and comprehensive nature, such as new and improved machine tools, he would never think of raising the question, knowing full well that he would get a return in the shape of reduced labour costs.

Under a Premium Bonus System, increased output is the result of a combination of two factors:—

- (1) On the part of the workman, in increased industry, care, thoughtfulness, and foresight, and the wisdom arising from increasing age and experience in economizing time and methods, all stimulated by an adequate, direct and immediate reward.
- (2) On the part of the employer, in providing better facilities, equipment, special small tools, more power, improved lighting, better supply of materials, and the numerous little helps of various kinds arising out of a better and more intelligent organization—short, of course, of new and improved machine tools—efforts continually applied and always operative, because of the stimulating effect of the knowledge that, by helping the man to save time and increase output, he, the employer, is thereby helping towards a reduction in his labour costs, and in that way gets his reward.

From many years' experience in my own shop, and a knowledge of what has taken place in other shops which have adopted Premium Bonus, I know that these two factors operate simultaneously and in combination. Indeed, they could hardly do otherwise, for, except in very exceptional cases, the mental outlook and impulse which cause an employer to adopt a Premium Bonus System, at the same time urge him to provide these additional facilities and to continue doing so. He cannot, and does not, wait till he finds out how much saving the man can make alone and unaided, and without his help, in the way of these additional facilities. Convinced of the benefits of the Premium Bonus System, he starts in at once to do his share and in this way contributes in no small measure to the total amount of time saved. He realizes at once the difficulty of ever being able to assess definitely the separate, or even the total, values of these hundred and one minor aids which he supplies towards the saving and increased output, and the consequent practical impossibility of ever being able to recompense himself for these by a reduction in the time allowance, even if this were desirable, which it certainly is not.

He is content to get his return by strictly and consistently adhering to the original time allowance and by doing all in his power to help

his men to do their best. It is to his interest to do so from every point of view—he gains the confidence of his men in his good faith, and this once established they, in their turn, having nothing to fear in the way of cutting, let themselves go. These influences act and react on each other, and a condition of mutual esteem and co-operation once set up, the results in the way of time saving are not only gratifying to both sides, but frequently quite amazing.

Piecework is very deficient in arousing these influences. One of the great complaints against the employer is that, once a piecework price is set, the employer does not bother any more about the matter, and that, therefore, the men cannot get the best output (and incidentally the most money) out of the job, because the employer will not provide the necessary additional facilities. Why should the employer do so, when it means that in order to help his men to make higher wages he has to expend more money, thereby increasing his oncost charges, in providing these desired additional facilities? He will not, and he does not, and not even the usual argument about the spread of charges over increased output will make him alter his mind. That factor, be it ever so well supported by elaborate arithmetical assumption, is far too remote and uncertain in its operation to have any real effect on the matter immediately before his notice. He insists, and rightly insists, upon some immediate *quid pro quo* for the additional help he is prepared to provide; and, rather than haggle with his men, and more often than not fail to agree, as to how much is to be taken off the piece price for each little help, he drops the whole business, lets it alone and gets just the output the men think it judicious to give him.

Now, under a Premium Bonus System properly administered, such a condition of affairs would automatically adjust itself, without any friction whatever. There would be no question raised about cutting down the Time Allowance to meet the value of these additional facilities, because this would be provided for in the automatic division of the time saved.

It is, therefore, to the employer's interest, immediately he adopts a Premium Bonus System, to add his efforts to those of the workman. The inducement is so strong that he cannot help doing so; and, from theory and experience, I assert that the increased output under the

Premium Bonus system does not arise solely from the workman's efforts and from these alone, but from the combined efforts and co-operation of the man and his employer. This being so, the employer is justly entitled, as has already been indicated above, to share in the saving of time; and the manner in which the respective shares are determined under Premium Bonus Systems will be dealt with in the next chapter.

Chapter IV

PREMIUM BONUS SYSTEMS

To avoid the temptation to cut the rates, and at the same time provide the required stimulus to the workmen, concurrently with a saving in labour cost, Premium Bonus Systems have been introduced—the “Halsey” and the “Rowan.” They are very often confounded with Piecework, especially the former, which, from one point of view, bears a strong resemblance to it; but there are important differences between both of them and Piecework; and as regards the “Rowan” system, one of fundamental importance between it and the “Halsey” system.

Before describing the Premium Bonus Systems, attention is drawn to the definitions in Table 2.

TABLE 2.
DEFINITIONS

- (1) The **STANDARD TIME** or **TIME ALLOWED** is the *average* time which the *average* workman—neither the quickest nor the slowest—takes to do the job under ordinary time rate conditions, when giving a fair rate of output for his time wages—no more and no less.
- (2) The **PREMIUM** or **BONUS** paid to the workman is that amount in hours which he receives for such saving of the Time Allowed as he may effect, and is over and above the actual hours he took to do the job.
- (3) The **TOTAL REMUNERATION** to the workman in Hours is the sum of the Actual Hours Taken and the Bonus Hours he earns and receives, *i.e.*, Hours Taken + Bonus Hours. This is also the Labour Cost of the job in Hours.

TABLE 2—Continued.

(4) The AMOUNT of the BONUS in HOURS is computed as under :—

$$\text{PIECE-WORK} = \left\{ \frac{\text{Piece Price}}{\text{Man's time rate per hour}} \right\} - \text{Time Taken} = \frac{\text{Bonus}}{\text{Hours}}$$

or = Time Allowed — Time Taken

$$\text{HALSEY} = \left\{ \frac{\text{Time Allowed} - \text{Time Taken}}{2} \right\} \quad \cdot \quad = \text{do.}$$

or = $\frac{\text{Time Saved}}{2}$

$$\text{ROWAN} = \left\{ \frac{\text{Time Taken} \times \text{Time Saved}}{\text{Time Taken} + \text{Time Saved}} \right\} \quad \cdot \quad = \text{do.}$$

Usually expressed as—

$$\frac{\text{Time Taken} \times \text{Time Saved}}{\text{Time Allowed}}$$

THE HALSEY SYSTEM

The Halsey System was originated by Mr. F. A. Halsey, a well-known American Engineer, in 1890. It was first introduced, I believe, into this country by Messrs. Weir of Cathcart in 1898, and is frequently known and referred to here as the Weir System. Under this system, let us assume that the Standard Time is, say, 100 hours. Then, whatever time the workman saves out of that 100 hours is divided between him and his employer in a certain fixed proportion. As Mr. Halsey originally worked it, the workman got one-third and the employer two-thirds of this saving. Messrs. Weir fixed this division at one-half to the man and one-half to the employer, and, as this is the proportion used by the firms in this country who operate this system, I shall base my figures and comparison on this division.

Under this system (see Table 3), if the man does the job in 80 hours, he saves 20 out of the 100 hours allowed. As a bonus, he gets one-half of this 20 hours saved, or 10 hours. He thus gets 80+10, or 90 hours' pay for 80 hours' work, and the labour cost to the employer is, therefore, 90 hours. If he does the job in 60 hours, thus saving 40 out of the 100 hours allowed, he gets as a bonus one-half of 40, or

TABLE 3.

HALSEY PREMIUM BONUS SYSTEM

The Time Allowed, 100 hours, is that which the average workman takes to do the job under time rate conditions.

A	B	C	D	E	F	G	H	
Hours.				Bonus Hours $\frac{C}{2}$	Workman's Earnings and Labour Cost for Job in Hours. $\left. \begin{array}{l} \text{Hours } \left\{ \right. \\ \text{Taken} \end{array} \right\} + \text{Bonus} \\ = B + E$	Increase of Output. $\frac{\text{Hours Saved} \times 100}{\text{Hours Taken}} \\ = \frac{C}{B} \times 100$	Workman's Earnings per Week of 54 Hours at 1/- per Hour. $= \frac{F}{B} \times 54/-$	
Allowed.	Taken.	Saved.						
		Amount.	%					
100	100	0	0%	0	$100 + 0 = 100$	0%	s. 54	d. 0
100	90	10	10%	5	$90 + 5 = 95$	11.1%	57	0
100	80	20	20%	10	$80 + 10 = 90$	25%	60	9
100	70	30	30%	15	$70 + 15 = 85$	42.8%	65	7
100	60	40	40%	20	$60 + 20 = 80$	66.6%	72	0
100	50	50	50%	25	$50 + 25 = 75$	100%	81	0
100	40	60	60%	30	$40 + 30 = 70$	150%	94	6
100	30	70	70%	35	$30 + 35 = 65$	233%	117	0
100	20	80	80%	40	$20 + 40 = 60$	400%	162	0
100	10	90	90%	45	$10 + 45 = 55$	900%	297	0

Column F amounts are shown graphically on Halsey 50% Curve, Table 5.

Do. E

do.

do.

Table 6.

20 hours, and he gets $60 + 20$, or 80 hours' pay for 60 hours' work, and the labour cost is 80 hours, and so on. Similarly, if he does the job in 20 hours, thus saving 80 hours, he would get, as a bonus, one-half of 80, or 40 hours, and his pay would be $20 + 40$, or 60 hours for 20 hours' work. That is, he would be making three times his standard time rate of wages, and the labour cost of the job would be 60 hours.

THE ROWAN SYSTEM

Turning now to the Rowan System, which was devised by my partner, the late Mr. James Rowan, and myself in 1898, and was put into operation in our works on the day the men started work after the engineers' big strike in 1897-1898, it will be seen that there is a very marked difference between it and the Halsey System.

TABLE 4.

ROWAN PREMIUM BONUS SYSTEM

The Time Allowed, 100 hours, is that which the average workman takes to do the job under ordinary time rate conditions.

A	B	C	D	E	F	G	H	
Allowed.	Taken.	Hours.		Bonus Hours $B \times \frac{C}{A}$	Workman's Earnings and Labour Cost for Job in Hours. Hours Taken } + Bonus = B + E = B $(1 + \frac{C}{A})$	Increase of Output %. $\frac{\text{Hours Saved}}{\text{Hours Taken}} \times 100$ = $\frac{C}{B} \times 100$	Workman's Earnings per Week of 54 Hours at 1/- per Hour. = $\frac{F}{B} \times 54/-$	
		Amount.	%					
100	100	0	0%	0	$100 + 0 = 100$	0	s. 54	d. 0
100	90	10	10%	9	$90 + 9 = 99$	11.1%	59	5
100	80	20	20%	16	$80 + 16 = 96$	25%	64	10
100	70	30	30%	21	$70 + 21 = 91$	42.8%	70	$2\frac{1}{2}$
100	60	40	40%	24	$60 + 24 = 84$	66.6%	75	7
100	50	50	50%	25	$50 + 25 = 75$	100%	81	0
100	40	60	60%	24	$40 + 24 = 64$	150%	86	5
100	30	70	70%	21	$30 + 21 = 51$	233%	91	10
100	20	80	80%	16	$20 + 16 = 36$	400%	97	$2\frac{1}{2}$
100	10	90	90%	9	$10 + 9 = 19$	900%	102	7

Column F amounts are shewn graphically on Rowan Curve on Table 5.

Do. E

do.

do.

Table 6.

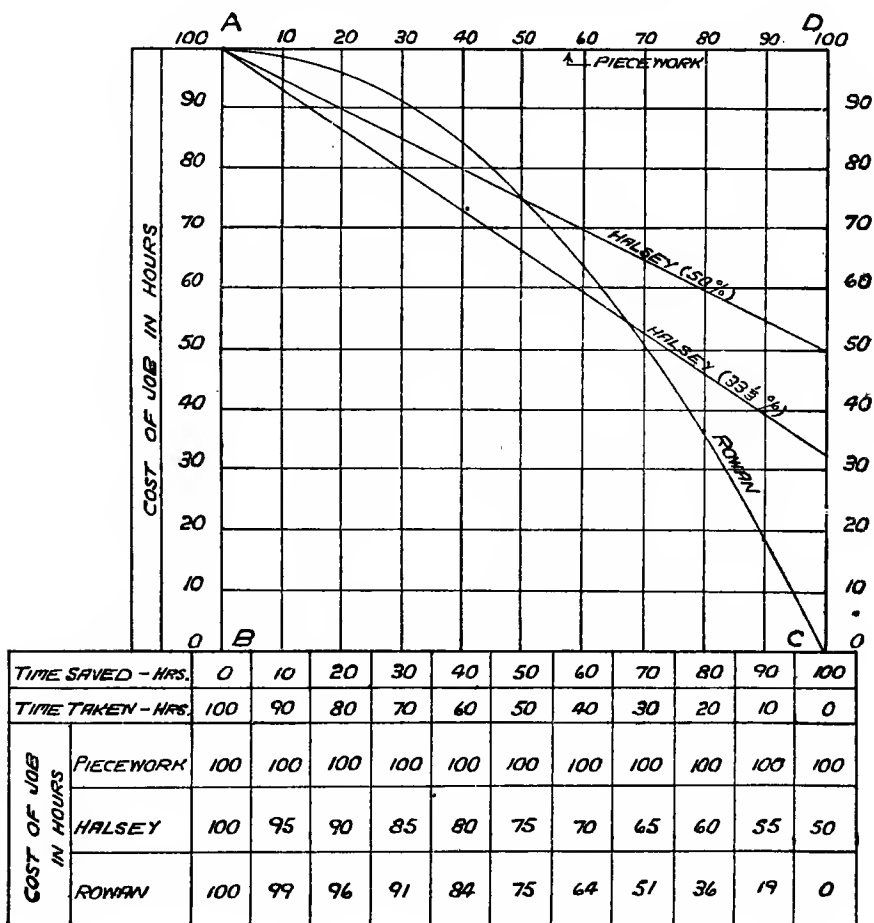
Assume, as before, the Standard Time to be 100 hours. Under this system, if the man does the job in 80 hours, he saves 20 hours, or 20% of the time allowed, and gets as a bonus 20% of the actual

time he took—80 hours, i.e., 20% of 80, or 16 hours. He thus gets 80+16, or 96 hours' pay for 80 hours' work, and the labour cost of the job to the employer is 96 hours. If he does the job in 60 hours, thus saving 40 hours, or 40% of the time allowed, he gets as a bonus 40% of the actual time he took, 60 hours, that is, 40% of 60, or 24 hours. He thus gets 60+24, or 84 hours' pay for 60 hours' work,

TABLE 5.

COMPARISON OF PIECEWORK, HALSEY, AND ROWAN SYSTEMS

Shewing Total Remuneration to workman, i.e., total labour cost in hours paid for, for any given saving on the Standard Time allowed—100 hours.



and 84 hours is the labour cost to the employer. Following out this process, if he could do the job in 20 hours (which I maintain under proper time setting is extremely unlikely, because of the physical limit I have referred to), he would save 80 hours, or 80% of his time allowance, and his bonus would be 80% of 20 hours, or 16 hours. He would get 20+16, or 36 hours' pay for 20 hours' work, or 1.8 times his standard time rate of wages, and the labour cost of the job would be 36 hours.

The total remuneration to the workmen, *i.e.*, the total hours taken + bonus hours earned, and, therefore, the hours cost of the job, are shewn diagrammatically in Table 5, for the Piecework, Halsey, and Rowan Systems respectively.

Both curves starting at 100 hours, the Standard Time allowed, gradually drop as the time taken decreases, or as the time saved increases; the curved line being the Rowan System and the straight line the Halsey. Observe how the curves intersect at 50% saving *i.e.*, when the job is done in one-half of the time allowed, and that at this point the remuneration of the man and the labour cost, under both systems, are identical. Observe also how, between no saving and 50% saving of the time allowed, the total remuneration to the workman under the Rowan System gradually increases over that under the Halsey System, attains its maximum excess at about 25% saving, and then reaches an equality at 50%. This means that the workman is more handsomely rewarded under the Rowan than under the Halsey System for any given saving between 0 and 50% of the time allowed.

On referring to the Tables and the Curves in Table 5, it will be observed that, immediately on passing the 50% saving point, the total remuneration in hours to the workman under the Rowan System, for any given saving from 50% onwards, immediately begins to fall below that under the Halsey System, the difference between them rapidly increasing as we get nearer the theoretical limit of saving.

For example, let us take 90% of saving, *i.e.*, when the job is done in 10 hours, if this were possible. Under the Rowan System, the bonus would be 90% of 10 hours taken, or 9 hours, and the labour cost 10+9, or 19 hours. Under the Halsey System, the bonus would

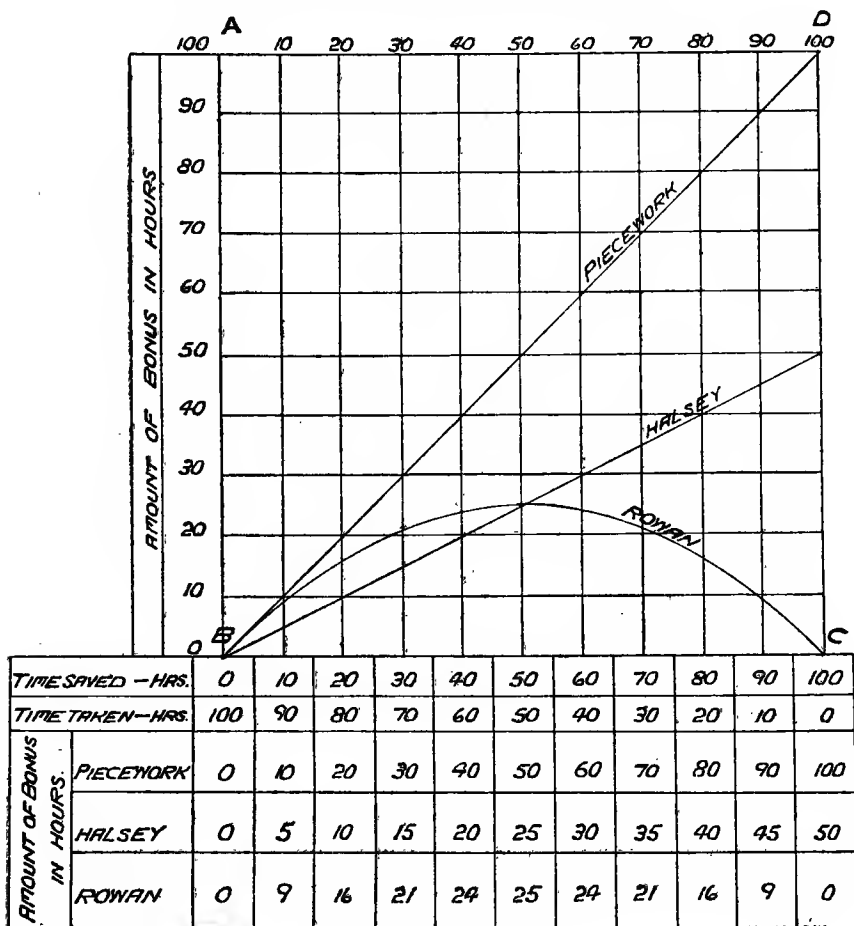
be half of 90 hours saved, or 45 hours, as against 9 hours under the Rowan System, and the labour cost 55 hours, as against 19 hours.

Following the comparison still further, let us assume the job could be done in 1 hour, thus saving 99 hours or 99% of the time allowed. Under the Rowan System the bonus would be 99% of 1 hour, the time taken, or .99 hours. The labour cost would be, and the man

TABLE 6.

COMPARISON OF PIECEWORK, HALSEY, AND ROWAN SYSTEMS

Shewing actual amount of bonus in hours over and above the workman's time wages for any given saving on the Standard Time allowed—100 hours.



would get, $1 + .99$ hours for 1 hour's work. Under the Halsey System, the bonus would be one half of 99 hours saved, or 49.5 hours, and the labour cost would be, and the man would get, $1 + 49.5$, or 50.5 hours for 1 hour's work, or $50\frac{1}{2}$ times his standard time rate of wages; although, as will be shewn hereafter, the advantage to the workman is more apparent than real.

Table 6 shows by curve and table the actual amounts of bonus in each of the three systems for any given rate of saving.

RATES PER HOUR UNDER THE VARIOUS SYSTEMS.

Let us now consider how the man's time rate per hour is affected under these various systems. In Table 7 this is set out in curves, and in the table at the foot of the diagram the actual figures are set down in tabular form. These show how the man's time rate per hour increases along with the saving in the time allowed under Piecework, Halsey, and Rowan Systems. The curved lines show how quickly, under the Halsey System, and how even more quickly under the Piecework System, the man's time rate per hour rises after the 50% saving point is passed. It will be noted how, under Piecework, his actual rate per hour reaches 300%, or three times his standard time rate, when he saves 66.6 hours or 66.6% of the time allowed; while under the Halsey System for the same saving, his actual rate per hour becomes 200% or twice his standard time rate.

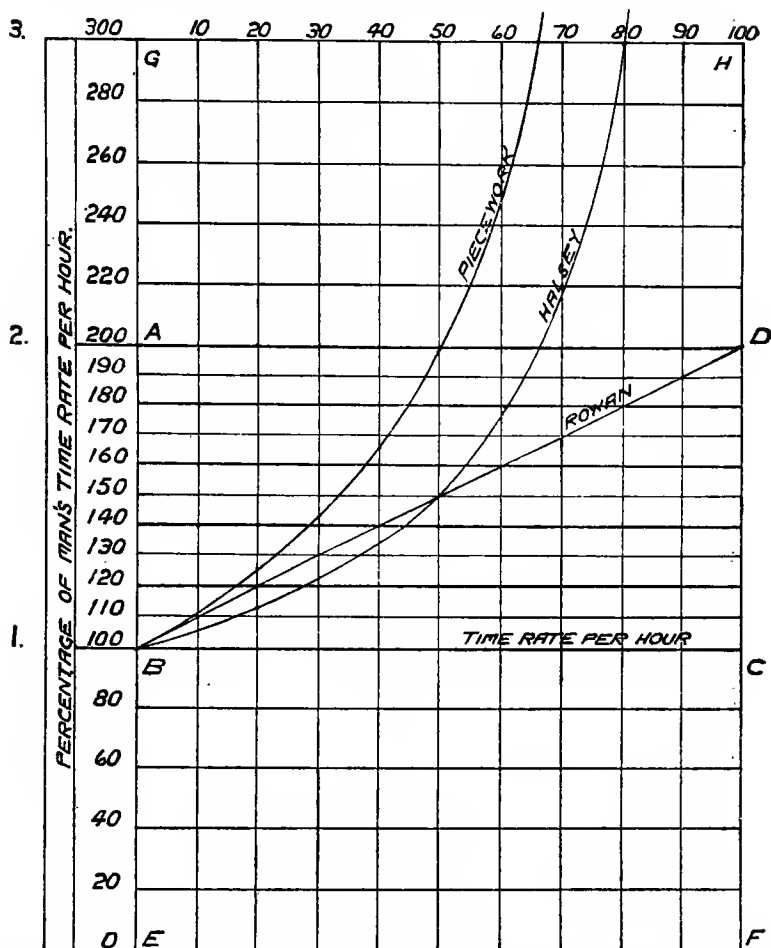
The similarity between the Piecework and Halsey curves in Table 7, it will be admitted, give some grounds for confusing the Halsey System with Piecework. These at first sight appear to be somewhat alike, the only apparent difference being that in Piecework the man gets all the saving, whilst in the Halsey System he gets half. At the same time, both the Halsey and the Rowan Systems differ very materially from Piecework in that they result in a reduction of labour cost along with the time saved, while in Piecework the labour cost always remains constant, irrespective of the time saved,

The straight line BD in Table 7 shows the man's hourly time rate under the Rowan System—it continually approaches the point D, but can never reach it. It is evident that under the Rowan System, as the man can never do the job in zero hours, he can never

TABLE 7.

COMPARISON OF PIECEWORK, HALSEY, AND ROWAN SYSTEMS

Showing increase in workman's time rate per hour for any given saving on the Standard Time allowed—100 hours.



TIME SAVED - HRS		0	10	20	30	40	50	60	70	80	90	100
TIME TAKEN - HRS		100	90	80	70	60	50	40	30	20	10	0
MAN'S TIME RATE PER HOUR	PIECEWORK	1	1.11	1.25	1.42	1.66	2.0	2.5	3.33	5.0	9.0	INFINITY
	HALSEY	1	1.05	1.12	1.23	1.33	1.5	1.75	2.16	3.0	5.5	INFINITY
	ROWAN	1	1.10	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.

double his standard time rate per hour, whilst under the Piecework or Halsey Systems he can theoretically reach an infinitely high hourly rate of wages by doing the job in an infinitely small period of time.

It is quite recognised and admitted by the workmen that, between no saving and 50% saving, under the Rowan System he is more handsomely rewarded for his saving than under the Halsey, as he gets a larger share of that saving than his employer. This is evident from Tables 5 and 6, and is frequently referred to as the "rich" half of the Rowan System. The reverse, however, is the case after the 50% point is passed, and because of this so-called "poor" half, the Rowan System has been subjected to a good deal of adverse and uninformed criticism, of which the following illustration is an example.

Suppose a man "A" does a 100 hours' job in 80 hours, thus saving 20%, he gets as a bonus 20% of 80 hours, or 16 hours. Another man "B" with the same time allowance does the same job in 20 hours, thus saving 80%, he gets as his bonus 80% of 20 hours, or 16 hours, exactly the same bonus as "A" got for taking 80 hours to the job. This, it is argued, is manifestly unfair to "B," as to give him only the same bonus as "A" is very inadequately rewarding "B" for doing the job in one-fourth of the time "A" took.

The obvious reply to this argument is that as "B" does four jobs in the same time as "A" takes to do one, he thereby earns four bonuses of 16 hours, or 64 hours in all, in the same time as it takes "A" to earn his single bonus of 16 hours. The actual rewards are in fact in exact ratio to their respective outputs, and this applies throughout the entire range of the system, and there is, therefore, no real inequality of reward between the halves of the scale. It only appears so until closely examined.

But there is a general reply to all the alleged defects and academic objections regarding the "poor" second half of the Rowan System. If, as I have urged, there is a limit, even with the assistance of the management, to a man saving more than 50% of the standard time allowance, then what is the use of considering or discussing what does, or does not, take place in the second half of either the Rowan or Halsey scales? It is outside the range of general practice, and there the matter ends.

I might here mention that, while the Unions have from time to time dwelt upon these alleged shortcomings of the second half of the scale, and urged these as reasons for objecting to the system, they have on other occasions scouted the idea of any of their members being able to double their time rate of output, much less treble it; and, while maintaining that their members as a rule work as hard as possible on time, *i.e.*, give the maximum output, yet, suggest that, if the output is to be increased, the way to get this is to increase the hourly time rate, and not to put them on piece or premium bonus. I think employers are to be excused if they decline to accept a system of payment which does not give them the means of checking the results arising from it, and insist, if they are going to pay more wages, that they have some direct and conclusive method of assuring themselves that they are getting value for that outlay.

Chapter V

THE BASIS OF COMPARISON

The primary object of all systems of payment by results is, of course, to increase the Time rate of output, and, to arrive at the measure of this increase, the basis of comparison must first of all be ascertained, and ascertained as correctly as possible.

Excluding manufacturing or purely repetition work, the Time rate of output, or capacity, of a general engineering works is a very difficult matter to arrive at, or to express in any but the widest and most general terms, but, however it may be expressed, the actual basis of that output is the average of the Time rates of output of all the workmen employed in the works.

Each workman, working on Time, has, in his turn, his average rate of output determined by the average time he takes to each of a succession of similar jobs, and if this time is, as it should be, a matter of known fact, or can with a little trouble be made so, we arrive at once at an elementary basis of comparison which, applied to each individual job as it comes along, will give, in the form of a Standard Time, the desired basis by which the saving in time and corresponding increase in output can be measured.

For Premium Bonus, the STANDARD TIME or TIME ALLOWED is THE AVERAGE TIME WHICH THE AVERAGE WORKMAN TAKES TO DO THE JOB UNDER ORDINARY TIME RATE CONDITIONS, WHILST GIVING A FAIR DAY'S OUTPUT FOR HIS TIME WAGES—no more and no less.

This means that, for a given job under a given set of conditions, there is one, and only one, Standard Time Allowance, without any regard whatever to the individual ability or capacity of the particular workman engaged upon it.

Being based upon the average time of the average man, the capable man has no difficulty in effecting a saving, and is duly rewarded by a bonus over and above his time wages for same, whilst the indifferent workman, making no saving or exceeding the time, gets no bonus, he gets only his time wages. He is not being penalized in any way for his failure to save time, as he always gets his time wages for the actual number of hours he spent on the job, even if these were in excess of the Time Allowed. Not having earned the right to a reward, he does not get it. He loses nothing.

The view has been expressed that the Time Allowance should be adjusted to suit each man's individual capacity, *i.e.*, for the same job under the same conditions, the time set should be according to each man's ability to reach a certain standard. The reason urged for this is that, as the reward is for the effort itself, equality of effort, whatever may be the actual result of that effort, should be equally rewarded, whether the man be a good workman or merely an indifferent one.

Applied in practice, this argument runs thus:—Out of 100 hours allowed, the capable workman does the job in 60 and saves 40 hours, and for the same job, under the same conditions, his less skilful neighbour can only do it in 80, saving 20 hours. Under the Halsey System, the capable man's bonus would be 20 hours, whilst that of the less skilful would be 10. Both having honestly made the same effort, it is argued they both should have the same bonus—20 hours—and, therefore, the Time Allowance for the less skilful man should have been $80 + (2 \times 20)$ or 120 hours. Apart altogether from the utter impracticability of an employer being able to set up and assess a separate standard for each individual workman in his employment, the more skilful workman would have a just grievance in not getting the same Time Allowance as his neighbour, and very properly demand that, if the employer can afford to allow the other man 120 hours, he can equally afford to give him the same, and let him make the greater reward out of his superior ability. He may not recognize the fact that he is demanding that he and his neighbour should be measured by a common standard (whatever that may be), as is done in every other walk of life; but, while not denying the equality of his own and his neighbour's effort, he is insisting, and quite rightly insisting, that the rewards should be for

the results of the effort, and not for the effort itself. This is merely mentioned to illustrate some of the peculiar views which are advanced and held in some quarters.

To take as the basis of comparison, or the Standard Time to be allowed, the performance of either the best or the worst workman would be not only cumbersome, but unreliable, because of the difficulty of ascertaining it in either case. In all other directions, we are measured by the standard of the average man, which standard is easily available. In Premium Bonus, the same course is followed, and accordingly the Standard Time or Time Allowed is the average time which the average workman takes to do a job, under Time rate conditions, whilst giving a fair rate of output for his time wages.

This, then, is the measure of the rate of output upon which an employer runs his establishment, calculates his output, and bases his estimates. It is the standard, and the only correct one, with which increased output and the corresponding reward to the workman can be properly compared.

Chapter VI

THE FIXING OF A TIME ALLOWANCE

To an employer who has decided to adopt any system of Payment by Results, the first difficulty which presents itself is how to arrive at fair and proper Time Allowances—allowances which will not be, on the one hand, so ridiculously low as to prevent any real effort to save time being made, or, on the other hand, so high that the employer is penalized for all time for his mistake.

From what has been said on the subject of Basis of Comparison (Chapter V.), it will be obvious that the proper Time Allowance cannot be other than the average time which the average workman takes to do the job under ordinary time rate conditions. Therefore, to the employer who has already at hand fairly accurate or reliable data of what was done in his shop under time rate of working, the matter presents no great difficulty. All he has got to do is to take these times, and, according to the system selected, if Piecework, multiply them by the standard time rate per hour, and he gets the Piece price—if Premium Bonus, fix these times as the Time Allowances.

But those who have not such data at hand have to face quite a real difficulty at the outset, which is too often taken to be insurmountable by those who lack the necessary courage and determination. Nevertheless, it is one which must be overcome, by properly and carefully dealing with it, before any progress can be made. To set times in a haphazard and careless manner is the poorest kind of policy, and a little care in this direction will save a world of trouble later on.

There being no royal road to knowledge, data regarding Time Allowances must be got some way, and the obvious and easy way is to obtain the services of an expert Rate Fixer, but these experts are

at all times limited in number and, at the present time, quite impossible to get. In any case, even an expert Rate Fixer has his limitations, and his knowledge and experience being obtained in the shops in which he was trained, his value to his new employer decreases the moment he is transferred from his old to his new shop, with probably a quite different set of conditions. The employer has accordingly to set about getting up this data as best he can, and he may do so by either estimation or observation, or a combination of both.

By estimation, not guessing, is meant the process of arriving at the total time by a detailed calculation or estimate of the time required for each of the elemental details comprising the complete operation. This process is now known as Motion Study, and, while scientifically sound and theoretically correct, it is by no means suited, in the initial stages, for the ascertainment of speedy and immediate results. Besides which, it requires a fairly large and skilled staff, and a certain amount of leisure time for analysis and comparison, conditions which are quite outside the range of possibility in the present strenuous times.

The only really safe method left to the employer is the much simpler one of observation; and, on the whole, this is probably the most satisfactory method for those coming straight on to Premium Bonus System from Time. Before fixing a Time Allowance, observations are taken of the total time required for the complete single operation from the time the man starts on the job until he starts on the next job. Beginning with one job, even in shops doing a wide variety of work, it is surprising how quickly data accumulate in the course of a few weeks. The times thus ascertained form the Standard Time Allowances which may be safely set and adhered to, without any anxiety or temptation to cut later on. If, at any future time, the method or means of manufacture are changed, then the job becomes a different one altogether; and the time is reset to suit the new conditions.

But, it may be urged by many employers, to give as the Time Allowances the times which are at present being taken, is to set up an unduly high Standard Time as a basis, because the times now being taken under war conditions compare very unfavourably with those

in pre-war times. This may be quite the case, and if so, it is a very sound reason for setting up, as the Standard Times, the times customary under pre-war conditions.

I fear, however, that this will not be an easy matter to carry through, for, apart altogether from the difficulty of now ascertaining what actually were the times taken under pre-war conditions, there is this aspect to be considered:—The Government are insisting upon the introduction of Payment by Results for the one and only aim of increasing the present rate of output and are not likely to allow their negotiations to be complicated by the introduction of factors outside the limits of the war period. In my opinion, it will be difficult, however desirable it may be, to carry through such an arrangement in the face of existing conditions, and Time Allowances may now have to be admitted and set much in excess, it may be, of what they would have been in pre-war times. If so, then employers taking up Premium Bonus or Piecework for the first time, will have to submit to this condition and its future consequences, as the price they have now to pay for their failure to appreciate and take up the system earlier.

There is no difference between having deliberately to fix the Time Allowances higher than they ought to be, and doing so unwittingly. Both are the results of mistakes and, therefore, carry certain penalties.

Under Piecework, any excess of hours over the proper time which should have been allowed is just so much loss to the employer, and the mistake in over-estimating the time factor in it can never be remedied or minimized, except at the cost of reducing the price, with all the attendant evils and drawbacks of doing so, but under the Halsey System, where the saving is divided, this excess of time, as it forms part of the saving, is divided equally between the workman and the employer, and the latter is, therefore, penalized for his mistake to only half the extent which he would be under Piecework. The penalty is even less under the Rowan System, and becomes relatively so as the error becomes greater.

This brings into prominence one of the greatest advantages of the Rowan System, viz., that under it, the temptation to cut the time

because of a mistake in over-estimating it, is, if not totally absent, at least reduced to a minimum; and, as a rule, to such a negligible quantity as to be quite inoperative—and this fact removes one of the principal difficulties of an employer in adopting Premium Bonus without having any previous records or data to work upon.

Let me bring out this point by one or two illustrations. Assume in the first instance (see Table 8) that the correct Time

TABLE 8.

EXAMPLE 1. 5% Increase on Correct Time Allowance

Time Allowance -	Correct.	Re-arranged.		
System - -	Rowan.	Rowan.	Halsey.	Piece-work.
Hours Allowed -	100	105	105	105
Do. Taken -	50	50	50	50
Do. Saved -	50	55	55	55
Do. do. % -	50%	52.3%	—	—
Bonus - -	$50\% \times 50$	$52.3\% \times 50$	$55 \div 2$	$105 - 50$
Do. Hours -	=25	=26.15	=27.5	=55
Add Hours Taken	50	50	50	50
Total Hours Cost	75	76.15	77.5	105

EXAMPLE 2. 10% Increase on Correct Time Allowance

Hours Allowed -	100	110	110	110
Do. Taken -	50	50	50	50
Do. Saved -	50	60	60	60
Do. do. % -	50%	54.5%	—	—
Bonus - -	$50\% \times 50$	$54.5\% \times 50$	$60 \div 2$	$110 - 50$
Do. Hours -	=25	=27.25	=30	=60
Add Time Taken	50	50	50	50
Total Hours Cost	75	77.25	80	110

Allowance is known to be somewhere round about 100 hours, and that, while all the indications point to this being the figure which should be taken, there is some little doubt on this point, which it is desirable should not arise. In order to settle the matter, and meet any fancied objection, it may be necessary to make some slight increase on the correct allowance of 100 hours, say 5%, or even 10%. It is of great assistance to the employer in coming to a decision, to know that the extra cost of this—it may be very necessary—concession will ultimately be such a comparatively small quantity as to present no temptation whatever to cut the time.

But, in the second instance, take an extreme case. Assume that, from ignorance or a mistake in the estimate, the Time Allowance has been fixed at a figure—say 200 hours—which later on is found to be twice what it should have been. Cases of this kind ought to be, and are, of comparatively rare occurrence, but, when they do occur, it cannot be denied that there would be, to certain men who take a short view of affairs, a temptation to work at time rate, which would be 100 hours, and this on a 200 hours' allowance would give them 50% bonus for no additional output. In such a case, it becomes the business of the employer to see that the man does the work in the minimum time. In this he is helped by the fact that a man in the habit of working at bonus rates does not readily slow up when a specially soft job like this comes his way. Knowing that under the Rowan System, the time once set will not be reduced, he is encouraged to do the job in his best time, irrespective of the amount of the Time Allowance; and can, as a rule, be got to do the job in exactly the same time as he would have taken, had he been given the correct time of 100 hours—that is to say, he will ultimately do the job in say 50 hours. (See Table 9.) In this case, he will save 150 hours, or 75% of the time allowed, and under the Rowan System his bonus will be 75% of 50, or $37\frac{1}{2}$ hours, and the labour cost of the job will be $50 + 37\frac{1}{2} = 87\frac{1}{2}$ hours, which is $12\frac{1}{2}$ hours less than if it had been done on Time. Under the Halsey System, the bonus would be one-half of 150 hours saved, or $75\frac{1}{2}$ hours; and the labour cost would be $50 + 75 = 125$ hours, or 25% more than if the job had been done on Time.

In Table 9 (Examples 1 and 2) is set out a comparison of the hours cost of a job under various conditions of excessive Time

TABLE 9.

P = Piecework. H = Halsey. R = Rowan.

EXAMPLE 1. 50 Hours taken. Varying Time Allowances.

	Standard			25% Excess			50% Excess			100% Excess		
Hours allowed	100			125			150			200		
Hours Saved -	50=50%			75=60%			100=66·6%			150=75%		
System -	P.	H.	R.	P.	H.	R.	P.	H.	R.	P.	H.	R.
Hours Bonus -	50	25	25	75	37·5	30	100	50	33·3	150	75	37·5
Hours Taken -	50	50	50	50	50	50	50	50	50	50	50	50
Tl. Hrs. Cost -	100	75	75	125	87·5	80	150	100	83·3	200	125	87·5

EXAMPLE 2. 60 Hours taken. Varying Time Allowances.

	Standard			25% Excess			50% Excess			100% Excess		
Hours Allowed	100			125			150			200		
Hours Saved -	40=40%			65=52%			90=60%			140=70%		
System -	P.	H.	R.	P.	H.	R.	P.	H.	R.	P.	H.	R.
Hours Bonus -	40	20	24	65	32·5	31·2	90	45	36	140	70	42
Hours Taken -	60	60	60	60	60	60	60	60	60	60	60	60
Tl. Hrs. Cost -	100	80	84	125	92·5	91·2	150	105	96	200	130	102

Allowances, while the time taken remains constant. These examples, along with those in Table 8, illustrate the superior elasticity in fixing Time Allowance which the Rowan System has over the Halsey and Piecework—a feature of great value when data or exact information are not available—and one of its chief merits, namely, the absence of temptation to cut the time.

The Rowan System, in fact, automatically adjusts the earnings of the workman. If the Time Allowance is stringent—then he gets more under the Rowan than under the Halsey. If excessive, he gets less. This, of course, is what ought to take place under such conditions, and the following illustration will show what is meant.

STRINGENT TIME ALLOWANCES—

		<i>Rowan.</i>	<i>Halsey.</i>
Time Allowed hours	- - -	100	100
Time Taken	- - -	80	80
Bonus	- - - 20% of 80=	16	$\frac{20}{2} = 10$
Total earnings	- - - -	96	90

EXCESSIVE TIME ALLOWANCES—

		<i>Rowan.</i>	<i>Halsey.</i>
Time Allowed hours	- - -	100	100
Time Taken	- - -	30	30
Bonus	- - - 70% of 30=	21	$\frac{70}{2} = 35$
Total earnings	- - - -	51	65

It will certainly be found that many jobs can be done under the influence of these systems in shorter times than either the employer or the workman ever thought possible.

I have said (page 34) that, in the absence of data, the only really safe method of fixing a Time Allowance is that of observation of the actual total time required for the complete operation at Time rate of working, and this actual total time should be the period between the finish of the one job and the start of the next. This being the average time taken under Time rate of working, no amount of argument can get away from the fact that any *real* saving of time, or any *real* increase in output, must be upon this observed time, and the output corresponding to it; and not upon this time enhanced because of all sorts of unfounded and illusory assumptions. The observed time is an established fact, open and patent to all concerned, and no reasonable workman could justify a refusal to accept it as a proper and sufficient Time Allowance, or maintain a claim that it should be increased.

However desirable it may be to accumulate data by the process of direct observation, the method is not always possible, and at the present time not altogether reliable, and the employer is forced, whether he likes it or not, to take up the process of estimation, and here he enters upon very thorny and difficult ground.

His object being to arrive at the Standard Time Allowance, he should not waste his time trying to estimate the minimum time in which the job should be done, and build upon that, or, as is the custom of several who use the Halsey system, trying to guess what should be the average time of the average man working at bonus rate, and build upon that.

Surely, if an estimate has to be made, it should be that of the Standard Time itself, rather than of some hypothetical time to which an addition, also based upon more or less hypothetical considerations, has subsequently to be made, in order to arrive at the proper Time Allowance.

This Standard Time is the time which has been taken day after day in the past, under ordinary Time conditions, and even the most indifferent methods of Time recording should provide some data capable of checking the estimate to some extent. Why, therefore, adopt the roundabout way of estimating for something else, and then add another estimate to that? At any rate, whichever method is adopted, the Standard Time arrived at should be the same in all cases.

I am certain that every reasonable man will recognise the absolute necessity of avoiding any procedure which will result in fixing a Time Allowance, under either Premium Bonus or Piece-work, higher than would be required if the job were done on Time. The main object of any system of Payment by Results should be increased output, and this will certainly not be obtained if extravagant Time Allowances or Piece Prices based thereon, are set. The pursuance of such a course, without any reasonable expectation of an adequate return, is simply using the system under guise of increasing output as a means of illicitly enhancing the hourly Time rates—a species of foolishness or chicanery which will inevitably bring its own punishment in due course.

At the same time, under the Rowan System, there is no excuse for reducing a Time Allowance, once it is established, unless the method or means of manufacture are altered. Not only is cutting dishonest, but it is the very poorest kind of policy, and if a firm do not appreciate and value the effect of the Rowan System in reducing, as far as possible, the temptation to cut, and are not prepared to work it honestly, then they had much better leave it alone.

Chapter VII

THE DIVISION OF BONUS

Unlike Piecework, under which the entire saving goes to the workman, Premium Bonus provides for a division of the saving between him and the employer.

Because of his contributory help, it seems quite natural to the employer that he should have a share of the saving, but not so to the workman, who asks why should the employer get any of it? He claims that the saving, with its consequent increase in output, is entirely due to the increased effort and additional physical exertion on the part of the workman, and, therefore, the whole of the saving belongs by right to him alone. As regards the increased physical exertion, I shall have something to say later on, but the soundness of the above argument rests upon whether or not the employer has had a hand in the resultant saving.

I have, in a previous chapter, shown that the saving is not due to the workman's efforts alone, but to the joint efforts of the man and his employer. If it be admitted that whatever part of the saving has been got by the workman's own unaided efforts is his and his alone, the right of the employer to that part of the saving arising from his assistance cannot be denied him, and the total saving, therefore, falls to be divided between them in proportion to their respective parts in achieving it. But here we are met with the practical difficulty as to how these respective efforts are to be separately assessed.

The ideal method would be first of all to ascertain how much saving was due to the workman's own unaided efforts; then to add what was due to the employer's help and facilities; and the difference between the resultant total saving and that part due to the workman

would be the value of the employer's help and facilities in hours saved. Then the hours saved by the workman would be his bonus, and those saved by the employer's help and facilities should be at the disposal of the employer.

A few moments' reflection will show how utterly impracticable such a method would be. An employer adopting Premium Bonus would require, first of all, to ascertain the individual capacity of each and every workman as regards his ability—unaided and without any help from the employer—to save time. To get this would require, in general engineering shops, months, even years, of patient and exact investigation, during which period the employer would have to keep his shop conditions exactly as they were under the former Time rate conditions. He would have to refuse to give any help whatever—he would even have to refuse to allow his machinemen to run their machines faster or take heavier cuts, as this would mean calling upon the employer to provide additional facilities in the shape of more power.

However, let us assume all this done, the employer never having had to take on new hands. He has now ascertained the average ability of each man to save time in terms of a percentage on the time allowance. He then proceeds to add his help and extra facilities to the men's efforts and the further saving of time over and above that already obtained by each man, as ascertained by the previously established records, belongs to the employer, and is taken by him as his reward for his assistance. In course of time, the accumulation of these facilities, a process which in well-managed and progressive shops never stops, but is continually going on, produces a set of conditions normal to that shop, and part of its everyday life. The employer then begins to have, for some reason or other, to change his workers, and take on new men. Those new hands may have come from a Time shop, or from another shop in which Premium Bonus is worked. In either case, no records of the men's own unaided ability to save time are available, because in the former case none exist, and in the latter are useless, as the conditions in that shop are not the same. Yet, in order that, in the case of these new men, the individual total saving may be properly divided, the employer must ascertain by actual trial, what the

capacity of each new man is, as regards his own unaided ability to save time. The only way in which he can do this properly, in order to put his new men on the same footing as his old hands, is to put the whole shop back under the conditions which existed when he was investigating the capacities of his original hands, *i.e.*, by abandoning the use of all the facilities introduced subsequent to that period, all of which is obviously quite impracticable, even impossible to carry out.

Consequently, as it is practically impossible to separately assess the value of the workman's and the employer's share in the total saving which is obtained, we are forced to deal with the matter by estimating and assigning an arbitrary division of what is due to the man and what to the employer.

In the Halsey System, as originally worked by Mr. Halsey himself, the proportion taken was that two-thirds of the total saving was due to the employer and one-third to the workman. Messrs. Weir assign a larger share to the workman, *viz.*, one-half, as the reward of his own unaided efforts, and in the Rowan System, between 0 and 50% saving, a still greater proportion is assigned to the workman.

For example, suppose in a 100 hour Time Allowance the man, by his own absolutely unaided efforts, managed to save 20 hours; he regards this, with considerable justification, as entirely his own. Let it be admitted that this is so. The employer comes along, and by his additional facilities the total saving is increased to, say, 40 hours. The workman has not worked any harder, nor done anything more to contribute towards this increase; therefore, the 20 hours' difference between the total saving of 40 hours and the saving of 20 hours due to the man's own efforts belongs to the employer. The man gets all the saving due to him, the first 20 hours of the total, and the employer quite properly gets the balance. The assumption in this case is that their joint efforts are equally effective—that is the basis of the Halsey System. It is a pure estimate, of course, and could never be practically demonstrated. Some doubt may, however, exist as to the justice of the assumed equality, and the Rowan System, by giving the man a greater share of the saving, goes a considerable way towards giving the workman the benefit of this doubt.

A good deal has been made of the extra physical exertion involved by increased output, and, in this connection, I would like to draw attention to some interesting facts derived from my own experience. Some years ago, in 1910, I had occasion to compile some data in connection with my own shop, to see how far the complaints then prevalent against Premium Bonus were justified as regards our system. It had been alleged that under Premium Bonus Systems the men were sweated—that task work was being imposed on them—that the older men would be unable to keep up the pace which would inevitably be set up, because of the increased physical effort involved, and would thus be pushed out of existence by their younger and fitter competitors, and so on.

Let me show how far these statements were justified by the results of my investigation.

In an engineering shop, the capacity of the establishment depends primarily upon the output of its machine shop departments—where all efforts towards increased output start, where results make themselves most clearly felt, and where one can most definitely connect effect with cause. Accordingly, I took our machine shop records and abstracted certain figures for the whole of the previous year—1909—a summary of which is set out in Tables 10 and 11.

TABLE 10.

AS REGARDS YEAR 1909—MACHINISTS ONLY:

Number of men who made over 40% Premium - - = 54 %
 Average age of men who made over 40% Premium - - = 43 years
 Average length of service of men who made over 40% Premium = 13 years

TABLE 11.

Results for 1909 of seven of our oldest Machinists.

Workman	A	B	C	D	E	F	G	Average
Service years -	22	25	29	35	34	38	18	29
Age - - -	44	45	50	50	54	66	70	54
Premium Earned	51%	43%	44%	51%	48%	52%	53%	49%

I wish, however, to draw particular attention to Table 11. Here are seven machinememen—turners, planers, slotters—who at that date had been longest in our employment—for periods varying from 22 to 38 years—and who therefore had been with us when we started the Rowan Premium Bonus System in 1898, and had been working under it ever since. At the date of investigation, the youngest of these men was 44, and the average age of the seven was 54. The average bonus earned by these seven men during the whole of 1909 was 49%—that is, they were then turning out work in 51 hours which, 11 years previously, these very same men took 100 hours to do—and what is more impressive, the highest bonus earner and producer of the lot was a man of 70 years of age.

Where is the extra physical exertion when these men—none of them in their first youth, the oldest being 59 when they started on the Rowan System—were yet able, 11 years later, and presumably when less physically fit, to work continuously at a rate of output nearly double that of their own previous performance under time rate conditions? Certainly a large part of this was due to the employer's facilities, but, allowing for all this, the fact remains that, as a rule, the highest bonus earners are usually the oldest and most experienced men. (See Table 10.) I think I may safely say that increased physical exertion does not enter into the question at all—certainly as far as machine work is concerned.

A large number of people, assuming wrongly that the workman is responsible for all the saving, naturally conclude that the workman should take it all, and support this opinion by stating that the employer is quite adequately rewarded by the spread of oncost charges over an increased output. This is a favourite and common argument used by those who object to the employer sharing in this saving of time. Its attraction is due partly to the fact that the obvious advantage to the employer of increased output cannot be denied, but to a greater extent it is due to the great difficulty of disproving the general statement as a whole, without entering into an almost interminable economic argument.

It is useless to argue with people who hold such views until they have been persuaded to give some little time to the study

of the Economics of Trade, or until they realise that, to meet the irresistible force of foreign competition, the cheapening of the production of any article cannot be adequately obtained solely by such reduction in cost as may arise from the spread of charges over an increased output, but must also involve a reduction in the actual labour cost of the article itself.

It by no means follows that such reduction of the labour cost of the article itself shall be at the expense of the workman's total earnings. What everyone in this country—workman as well as employer—has to realise, especially at this time, is that he must give in the future more output or value for a given money return than has been done in the past, if the nation is not only to prosper and increase, but even to live, under the fierce competition we shall be met with when the war is over.

It is a mistake to assume that the employer is adequately rewarded for increased output by the resultant reduction in oncost charges, or to dismiss the whole matter off hand, as is too often done, by the general statement that, if the man doubles his output, the employer's overhead expenses are halved, and he can, therefore, afford to pay the man double wages, leaving it to be inferred that the saving in oncost goes to swell the employer's profits, and that, therefore, he is sufficiently rewarded thereby. The question goes much deeper than these superficial comments indicate.

No firm engaged in engineering work could possibly double their output from their workmen's efforts alone. They would require to expand their Buildings, Plant, and Organization. This, in its turn, would increase the gross amount of their oncost charges, and, before they had reached the double output stage, there would not be very much left of the 50% saving in charges, which is so frequently and easily assumed to follow upon double output. Increased output undoubtedly helps to reduce the oncost charges rate, but it also increases the gross amount of these, and whatever saving there may be from the spread of charges, does not go to swell the employer's profits, unless these had formerly been below the standard rate, but is used to reduce the selling price to the consumer—to help the employer to meet foreign and home competition—to extend his market—and last, but not least, to ensure a continuity

of employment for him and his work people. Not only is this the case in respect to savings from spread of charges, but it applies to all other savings, including such as are made in labour cost, after paying for the increased facilities, without which these savings would not have been made.

To enter fully into the various and complicated economic aspects of this question would require more space than the limits of these pages, or my time, will permit, but I cannot do better at this stage than reprint an excellent leader summarizing the position, which appeared in the *Engineer* of 16th March, 1917, and which runs as follows :—

"The Partition of Bonuses

" A correspondent has raised a question that has always to be
" faced sooner or later by the manager who proposes to intro-
" duce the Premium system of paying wages. Why should not
" the workmen be paid for all the time saved? We have
" endeavoured in notes attached to his letters, to indicate,
" rather than formulate, answers to this question, but, in view
" of the importance of the matter, and of the need that managers
" should be in a position to meet arguments of the kind, it may
" be as well to consider the problem in more detail. Let us
" admit that it is an extremely difficult one to handle, because
" a variety of economic questions is involved, and, if once we get
" outside certain narrow limits, we are led into an interminable
" train of arguments. On the other hand, the faulty view of
" the workman is due to the fact that the limits he puts to his
" investigations are too narrow, and, unless we give ourselves
" a somewhat wider field, we cannot hope ever adequately to
" understand the position, yet we must use some care not to be
" lured too far from the main point.

" In the first place, we must notice that the premium system
" is used with the object of increasing output, and increased
" output is necessary to strengthen our trade. But there is no
" good having a large output if the price is so high that no one
" will buy the product. Conversely, the manufacturer who
" can sell the best goods for the lowest price stands best chance
" of getting the orders. All this seems so obvious as to be hardly
" worth stating, and yet, when high wages are being talked about,
" it is frequently forgotten. The workman takes the view
" that the saving effected by his increased output goes directly
" to swell profits. As a matter of fact, it does nothing of the
" kind, save in cases where the profits have been originally too

“ low. To see the matter in its proper light, we must take our
“ attention off the manufacturer’s profits and centre it upon
“ international trade. We must think of the competition from
“ foreign manufacturers and consider the possibility of meeting
“ it by asking a lower price for goods of at least equal excellence.
“ We admit willingly, in fact, we have written articles in this
“ column to demonstrate the fact, that employers can afford to
“ pay much higher wages, if the output be increased. Their
“ plant, their capital, and their time, are better employed, and
“ the result is that a big output is always advantageous. But it
“ is perfectly clear that, if the employer pays more in wages
“ than he need pay, then he is still keeping the selling price higher
“ than it might be, and our object is to get the selling price
“ down to the irreducible minimum. It is usually taken that
“ manufacturing costs are made up of three equal parts, oncost,
“ cost of material, and labour. The total cost is influenced
“ directly or indirectly by the last. Directly, for if labour cost
“ is high, one part of the total cost is raised, and indirectly,
“ because material costs more if steel workers and so on are paid
“ too much, with the result that oncost on buildings and the
“ cost of the rough materials of manufacture are more expensive.
“ The necessity of keeping labour costs low has always been
“ recognised by economists and cannot be denied. If we could
“ maintain wages at the same rates as before the war and double
“ the output of our shops, we could rule every market in the world.
“ But that would be unjust. We are quite prepared to pay
“ the workman more, and a great deal more within reason.
“ Possibly the argument can be best put by using a wholly
“ impersonal case. Let us assume that an employer has a
“ steam engine in his works that is consuming three pounds of
“ coal per indicated horse-power per hour, but is underloaded.
“ Now let him increase the load up to the point of maximum
“ efficiency. He is getting more out of the engine and saving
“ in that way in oncost. But no one would say that, as a
“ consequence, he would be justified in taking less care with
“ his coal, since it would not matter if some were wasted. His
“ consumption ought to come down to two pounds and a half
“ per indicated horse-power per hour. If it did not do so, he
“ would obviously be throwing away some 18 per cent. of his
“ fuel. Everyone will admit the correctness of this argument.
“ But it follows precisely the same line as the argument applied
“ to labour. To give labour the whole of the time saved is
“ exactly equivalent to wasting the half-pound of coal per
“ indicated horse-power per hour which might be economised.
“ This is not a question of the ethics of socialism, it is a question

“ of economics. In order to compete in the markets of the
“ world we must manufacture cheaply, and we must constantly
“ endeavour to keep the total cost per piece—oncost, material,
“ and labour—as low as possible. Would the workman say
“ that the landlord of a works should double his rent because
“ the management was so good that the output had been
“ doubled, or that the steel and copper merchants should charge
“ more for their goods because the manufacturers were able to
“ work them up more rapidly than before? Yet they are
“ asking for similar things when they claim that the whole of
“ the economies effected in labour should go to them.

“ Now, regard another aspect of the problem. The workman
“ who finds a bonus in his envelope regards it as an addendum
“ to his wages. It is something over and above a certain
“ statutory sum. But the employer looks upon his share of
“ the bonus in quite a different light. It is not so much more
“ money in his pocket. It is not a bonus or anything like a
“ bonus. It means simply and solely that he has reduced his
“ manufacturing costs, and that, in consequence, he can sell more
“ cheaply and is likely to get more orders. Of course, he gets
“ some profit out of a greater turnover, but as he has to work
“ harder to handle that increased output, and has certainly
“ expended capital and revenue in getting it, he deserves some
“ share of the saving. If it would be unfair to ask the workman
“ to make a special effort for no reward, it is surely equally unfair
“ to ask the employer to do so. He, also, is worthy of his hire.
“ The point of view taken by our correspondent, and by many
“ who think with him, is that the employer gets sufficient reward
“ from this decrease of oncost. If that is to be his reward, and
“ that only, then since he is to keep that for himself, and the
“ labour cost per piece is just as high as before, he cannot reduce
“ his price on the market. But that is the very thing we want
“ him to do. We want him to undersell all other manufacturing
“ nations, and there is far less chance of doing that if labour
“ costs are excessive. Finally, it must be observed that, if
“ employers were required to pay the whole of the bonus time
“ to their men, they would give up the bonus system altogether
“ and go to closely priced straight piece work, under which
“ the workman appears to take the whole proceeds of his
“ augmented output.

“ In this argument, we have endeavoured to keep the large
“ aspect of the question to the front. It is necessary that we
“ should think of the matter from a national, rather than from
“ a parochial, point of view. The object to be attained is the

“ cheapening of our products. That we know can be achieved
“ by increasing the output per man and reducing the labour cost
“ per piece. Labour must be paid adequately. It must get
“ more for more work, but, if it asks for an exaggerated return
“ for its efforts, it will defeat the object for which we are
“ striving.”

I am convinced that any system of Payment by Results which does not provide, along with an inducement to the workman to save time, a similar equally powerful inducement to the employer to help towards that saving, is bound in the long run to be inoperative or at most only partially successful. If, therefore, an increase in output, along with a reduction in labour cost, can be obtained, and, at the same time, handsomely increase the total earnings of the workman himself, surely he should have nothing to object to or complain of from his point of view.

Chapter VIII

THE CHOICE OF A SYSTEM

One of the most important matters which an employer changing over from Time to Payment by Results has to consider is which system to adopt—and equally important at the present time, because of the existing labour conditions, is which system he can get his workmen to accept.

Piecework, Halsey, and Rowan are all recognised systems, and have been established throughout the country for many years, with varying degrees of success, as means of increasing output. It is for this purpose that the Government is at the present time pressing for the general adoption of a System of Payment by Results, and, as the employer is, or should be, the only person responsible for the output and management of his establishment, he only is qualified to decide which system is best suited to his own particular conditions, and the decision should rest in his hands alone. The workman is placed at no disadvantage by this—he is not having thrust upon him a system which is novel or experimental in its operation. Considering the many thousands of his fellow workmen who have been working under one or other of the systems for many years, it is evident that there will be no hardship or disadvantage from his point of view in having to work under one or other of these systems. If, however, he has any objections to the choice made by his employer, these, if well founded, will have much more weight if they are raised after a fair trial of the selected system, rather than before. To prejudge the case before proof, in the face of the known and admitted fact that the objections raised are of no particular moment in other shops where the system in question is being worked, is to display so narrow an outlook and so irrational a standpoint as to be unworthy of serious consideration.

The arguments usually put forward against a system to which the workers object have so far been remarkable rather for their flimsiness than their reality—the principal one being the uselessness of expecting a successful result from men working under a system to which they are opposed. This objection, however, almost always comes from men who have no experience whatever of any system, and, therefore, has little or no weight, and instances are not wanting in which the strongest objectors become the strongest supporters, when they have once tasted the benefits arising from an actual experience of a properly worked system.

The employer, on the other hand, has to take a much wider view of the question. Knowing that his men under any one of the systems will be adequately rewarded for their efforts, he has to keep in view the necessity for increased output, and has to consider how best this can be obtained under the existing conditions of his business. His selection, therefore, will be determined by the relative values which these conditions cause him to place upon the individual characteristics of the various systems as regards speed and ease of introduction, and safety from penalty in the working of them; and, unless he adopts the system which best suits his particular conditions, of which he is the only competent judge, he will be unduly handicapped in his efforts, with a corresponding decrease in efficiency.

As far as he personally is concerned, the first question the employer will have to decide is, whether to have Straight Piecework or Premium Bonus, and it will largely depend upon the condition of his business and the nature of his products—but principally the latter—whether one or the other will prove more suitable on the whole. While I am a strong advocate of Premium Bonus, because of its all round intrinsic merits, and am of opinion that there are not many industrial occupations to which it could not be successfully applied, yet, as far as Engineering is concerned, the range and variety of its trades are such, that one cannot but admit that, in certain cases, Piecework may be quite as attractive, and on the whole as satisfactory to the employer as Premium Bonus.

Quite apart from questions of organization, and looking only at the product and the nature of the operations involved, there are two

considerations which will influence the Employer's selection. The first and the principal consideration will be the extent to which repetition enters into the question, and also the intensity of the repetition, *i.e.*, the number of times an operation is repeated per month, week, hour, or even minute. Into all engineering work nowadays repetition enters to a greater or less extent. Competition and the natural inclination to confine oneself to making those articles one knows, lead one to specialise as much as possible in one particular product, or series of products. A shipbuilder may turn out twelve exactly similar hulls in a year, and to this extent may be said to be engaged on repetition work, but as regards his ability to establish correct Time Allowances, he stands in a very different position from say, the sewing machine maker or the shell fuze manufacturer, who turns out his products by the hundreds or thousands per day. In the case of the shipbuilder, a certain operation may be repeated only once per month, while, in the other case, it may be done dozens of times per hour. The sewing machine maker or fuze manufacturer can afford to spend many days, even weeks, in repeating observed operations hundreds of times, from which it is a comparatively simple matter for him to deduce, if not the minimum time for any particular operation, at least something so closely approximating it that he is able to fix very closely set Piecework prices, without much anxiety regarding mistakes or any great difficulty in getting these accepted. These prices, while allowing the workmen to make a reasonable increase on their time wages, will have already discounted the value of all the facilities which the employer has, by his experiments previously, ascertained to be necessary to give him his expected output. The shipbuilder is in no such fortunate position. It would take him a lifetime to make as many repetitions of his operations as the fuze maker could make of his in one day, and he has, therefore, to content himself with one or two observations, or a pure estimate, upon which to fix his time allowance, and select the system which will penalize him least for any mistakes he may make.

While, then, it would appear at first sight that, as regards pure and intense repetition work, there may not be very much to choose between Piecework and Premium Bonus, it must be admitted that the more closely that class of work is approached the less apparent are the advantages of Premium Bonus, but these never disappear altogether—

they are still there even in pure repetition work. Our shell factories abound with examples, in which even the most closely set piece price has in a short time been shown to have been ridiculously high by the addition of, or alteration to some small fixture, or some other slight change, involving a re-arrangement of the price, if possible, or, if not, a continuance of an unnecessarily high labour cost, neither of which defects would have arisen under the Halsey, and still less under the Rowan System.

Conversely, the further we get away from pure and intense repetition work, the more marked become the advantages of Premium Bonus, in either machine or hand work, and as regards the majority of engineering establishments doing general work, even if such be repetition work, there is no question that Premium Bonus is the system which should be used. Here again it will depend upon the intensity or recurrence of the repetition work, as regards its facility in providing opportunities for observing times, whether the Halsey or the Rowan System be used; but even in this respect, and for other reasons already discussed, the employer and workman will be on safer ground if the Rowan System be adopted.

In addition to the consideration of the amount of repetition, there has to be taken into account the extent or amount of machine work which enters into the product. Between pure handwork, on the one hand, and pure machine work, on the other, there is an immense variety of products in which machine work is more or less the ruling factor. While it may be the case, that the greater the extent of the machine work, the easier it is to ascertain times for it than for handwork, because of the more determinate and calculable factors in the former than in the latter, the employer has to review not only the amount or extent of this machine work, but also its character, and to consider an aspect of the machine work itself which must not be overlooked. In every machine operation, there is always a certain amount of the total time occupied in preparing, setting up, and dismantling—the balance being the time the machine is actually working. The ratio which this balance bears to the total time has to be taken into account in time setting—not only so, but the nature of the actual operation itself cannot be neglected, *i.e.*, whether the feeds and speeds are within the discretion of the operator, and if so, to what

extent. Take, as an extreme example, at one end of the scale—the hobbing of the teeth in the large wheel of a Marine Geared Turbine set, an operation taking in some cases 600 hours, in which the time of setting up and dismantling will be under 10% of the whole. The machine, once set, moves at a uniform pace, and without once stopping, for 550 hours, during which time all that the operator has to do is to see that nothing goes wrong. Here is a job in which over 90% of its rate of output is definitely and unalterably established. There is no possibility of saving time on this part of the job. Any saving which can be made, must be made in the setting up time, which is quite an insignificant fraction of the whole.

Further down the scale, we come to the great bulk of the operations in a machine shop, in which the setting up time—where most of the saving can be made—may in some cases run up to 5 times the actual running time of the machine; not only so, but, in the running of the machine itself, the workman has a wide discretion regarding feeds and speeds. The field for saving time is now very much enlarged, and, as experience shows, is a very fruitful one indeed. It becomes more and more so as we approach the conditions in which machine work is absent altogether, and the whole of the operation is carried out by the workman's own hands, supplemented by a few simple hand tools, and such facilities of a general or special kind as are found necessary.

Speaking generally, the further we get away from machine work, and/or the further we get away from pure and intense repetition work, the greater becomes the difficulty in setting time allowances within a reasonable margin of accuracy, because of the greater indeterminateness of the other factors involved. This leads to a greater liability to mistakes, and, therefore, the more important does it become to have a system under which the penalties for such will be reduced to their least possible dimensions.

It is no argument to say that mistakes in time setting arise from carelessness, and, therefore, it is the employer's business to see that these are properly guarded against. To a certain extent this may be true, but where is the business, trade or occupation from which carelessness is entirely absent? There is none; and even with the best intentions in the world, and the most elaborate care and precaution,

the liability to mistakes in time setting is ever present, and when mistakes do arise, it is to the ultimate advantage of everyone concerned that the system in operation should be that in which anxiety as to the results of such mistakes is reduced to a minimum. This condition greatly adds to the ease and speed of introduction of the system.

In a leading article on the Rowan Premium System which appeared in the issue of the " Engineer " of the 22nd November, 1916, the Editor closes his remarks by stating:—" From all of which it comes about that in works in which the production is of a kind that makes accurate time setting difficult, or in works which have no records to work upon, or which desire to establish a Premium System rapidly, the Rowan System is miles better than other Payment by Results Systems."

Chapter IX

THE EFFECTS OF THE SYSTEM

It must not be supposed that the Premium Bonus System is a panacea for all the ills that workshop management and labour are heir to. Good as it may be, and excellent as it is in very many directions, it is at best a tool, and a tool it will and must always remain. I have never pretended that it is, or will ever be, a substitute for good management—nothing can ever take the place of that—but in the hands of good, honest, and progressive management it will work wonders in many curious and unexpected directions.

Not the least part of the benefit which it carries with it is the education of the employer. I have always held that all the money we spent on the introduction and evolution of our system (and it was no mean sum, as we were pioneers in a hitherto unexplored country), was well spent in disclosing to us our own hitherto unsuspected deficiencies and short-comings, and opening up a vista of possible improvement, undreamt of up to that time.

To those who are open and willing to receive a lesson, and act upon it, I know of no finer spur or stimulus than the Premium Bonus System. To put it on the lowest plane, it pays the employer, and it certainly pays the workman handsomely—as will be seen by an inspection of Table 12. These are not selected examples, but are the figures relating to the first six names in our Wages Book of each of the classes given.

Table 1 on page 12 is interesting and instructive, and requires a word or two of explanation. The Premium Bonus System was started, as I have said, in our own shop in 1898, prior to which the shop had always been on Time; and, as far as its plant, equipment, and organization were concerned, was probably about the average of that period. As we were breaking quite new ground, and had no outside information or experience to work upon, and only our own initiative to guide

TABLE 12.

Class.	Weekly Average for whole of 1913.						Weekly Average for Quarter ending 4th July, 1916.					
	Work-man.	Hours Worked.	Hourly Time Rate.	Wages.			Hours Worked.	Hourly Time Rate.	Wages.			Premium Earned Rate.
				Time.	Premium.	Total.			Time.	Premium.	Total.	
		1	2	3	4	5	1	2	3	4	5	6
Turners.	A	53	9.75	43/-	22/10	65/10	62	10.75	60/-	27/-	87/-	44%
	B	51	9.5	40/5	19/3	59/8	50	10.75	45/3	17/5	62/8	39%
	C	52½	8.75	38/3	14/-	52/3	63	9.75	49/9	21/-	70/9	38%
	D	53	9.25	40/9	18/2	58/11	61	10.25	53/5	20/9	74/2	39%
	E	52	8.5	36/11	8/7	45/6	53	9.5	42/11	10/9	53/8	25%
	F	52½	8.5	37/2	15/6	52/8	54	9.5	42/10	15/9	58/7	37%
Fitters.	G	50½	8.5	35/10	13/3	49/1	51	9.5	41/1	7/6	48/7	18%
	H	55½	8.5	39/4	12/-	51/4	55	10.0	48/6	13/6	62/-	28%
	K	45½	8.75	33/4	10/5	43/9	48	10.0	39/11	15/-	54/11	37%
	L	50½	8.5	35/7	8/3	43/10	60	10.0	53/4	13/6	66/10	26%
	M	53½	8.5	37/10	6/11	44/9	58	10.0	50/9	19/10	70/7	39%
	N	50	8.5	35/5	11/9	47/2	58	10.0	51/3	14/10	66/1	29%
Smiths.	P	49	9.5	38/10	16/5	55/3	47	10.5	41/6	20/7	62/1	49%
	Q	51	9.0	38/1	15/-	53/1	46	10.0	38/3	17/11	56/2	47%
	R	54	8.75	39/4	17/6	56/10	53	10.0	44/4	22/-	66/4	49%
	S	53½	9.0	40/1	19/7	59/8	52	10.0	43/3	22/11	66/2	52%
	T	53½	8.5	38/-	17/9	55/9	52	10.0	43/4	21/3	64/7	49%
	V	54½	8.5	38/6	17/2	55/8	52½	10.0	43/10	21/2	65/-	48%

NOTES TO TABLE 12.

Col. (1) "Hours Worked" are the actual hours worked only, and exclusive of over-time.

Col. (3) "Time Wages" not only include the money value of the hours worked, but also the money value of all half time for over-time, and other allowances such as travelling, etc.

Col. (4) "Premium Wages" are the money values of the premium hours earned.

Col. (6) "Premium Earned" is the ratio of time saved to time allowed and is also

$$= \frac{\text{Col. 4}}{\text{Col. 1} \times \text{Col. 2}}$$

us, it will readily be understood that a good many months must have been spent in getting the system well under way. The various possibilities and influences arising out of the system began to appear and make themselves felt at quite an early stage. These involved such a reconstruction and re-organization of our previous methods and appliances, that a still longer period elapsed before they could be carried out and their effect become operative. For the three or four years beginning with 1900, a steady and continuous supply of new and improved machine tools, appliances, facilities, and methods was provided, until the shop was re-equipped on a modern and up-to-date footing, after which the process became one of rounding and filling up the minor requirements, and replacing what had become obsolete.

The year 1899, the first completed year of the system's operation, may be taken to roughly represent the period during which neither new machine tools nor very many of the ordinary additional facilities in the way of jigs and fixtures—although ordered and under way—had time to be installed or become fully operative. While it might, therefore, be taken to represent approximately a period in which the saving in time was, to a considerable extent, the result of the men's own unaided efforts, it was not by any means entirely so. This period was marked by continued and serious break-downs in these old machine tools, and by a sudden and serious jump in the demand on the firm for power, which showed that the men were now taking far more out of their tools, and stressing them more severely than ever they did on time. It will be noted how quickly the average premium rises from 1900 to 1902. This was the period during which we designed and put into use, without stint, jigs, fixtures, and additional facilities of all sorts and descriptions, and the rise in the average bonus earned was largely due to these alone and not to the new machine tools for which, when they came into operation, new Time Allowances were set, under the conditions stated on page 13. In 1908, the average drops from 43% to 39%. This was a year of very dull trade and a good deal of unemployment and short time. Work was scarce and difficult to get; and not being able to pick and choose, as is the case in busy times, we had a greater variety of work passing through the shop than usual—all of which conditions were reflected in the lower average bonus earned. The fall in 1911 was due to the

necessity for a nightshift, involving the employment of a large number of new men.

The Premium Bonus System provides methods of getting at and dealing exactly with all kinds of questions, which as a rule are only vaguely guessed at under time conditions. For example, we once had a group of three machine tools located in a cramped and inconvenient position. This was more or less evident at the time, but what it meant did not become apparent until they were shifted to a new and more convenient situation and given ample room. The results of the new arrangement are given in Table 13.

TABLE 13.

Machine.	Saving.		Output increased by
	Time.	Money.	
Double-headed Horizontal Borer -	per cent. 3·9	per cent. 2·5	per cent. 4
H. and V. Planer -	22·5	14	29
Connecting-rod Lathe -	12·8	8·3	14·7

In this comparison, the conditions were as nearly as possible the same in both cases—the machines were doing the same kind of work—the same men were at the machines and were working under Premium Bonus throughout. An average taken over a long period, under both conditions, showed that the men working the three machines made 9·3% more wages, the work was 8·3% cheaper, and the output was increased 15·9% by the mere change in location of these three tools.

Table 14, extracted from my records of our first few years' experience of Premium Bonus, gives some examples of the extent to which the Times on certain jobs were reduced by the application of the system, and the substitution of new and improved machine tools.

It is a fairly common impression in certain quarters that Premium Bonus causes indifferent workmanship. Quite the opposite is the case, if ordinary precautions are taken, and as regards machine work, I early came up against this problem, which solved itself in a very effective and quite unlooked for manner.

When we put our fitters and erectors on Premium Bonus, which took place shortly after we had got it installed in the Machine shops, their Time Allowances were, of course, based upon the assumption that the machine work which they had to put together was correct and satisfactory. If the machine work was not up to the standard, and therefore, required rectifying, the fitters did not fail to complain and point out that this involved more time than was covered in their Time Allowances. A few examples of this kind, promptly and impartially investigated, in the presence of the machine men who were at fault, speedily convinced them that cases of indifferent workmanship could, and would always, be brought up against them and carry the prescribed penalty, however long a time had elapsed since the incident had occurred, with the result that any tendency in this direction was checked at the outset. The erectors, in fact, became the best machine work inspectors we could have.

One of the most successful applications of Premium Bonus is in our Smiths' shop. There the striker to each smith has his time wages increased by whatever percentage of premium his smith makes, and thus has a direct inducement to do all he can to help forward the work. The same principle applies with all heavy machine tools which have helpers constantly in attendance—these helpers also get their time wages increased by the same percentage as the machineman himself makes. This method works very satisfactorily in squad or gang work, when helpers are continuously engaged on the job; but, as this is not always the case, it becomes rather a difficult matter to deal with general shop labour on these lines; still, wherever this is practically possible, it should be done.

Premium Bonus is also applied by us to all skilled men who, from the nature of the job (such as erecting and fitting machinery on board ship) have to work in squads. The method is simple, and is independent of the number of men who form the squad, or the length of time each man spends on the job. The total number of fitter hours which are taken to the job is compared with the total number of fitter hours allowed, or the Standard Time, and the percentage of premium determined as a whole. Each man then gets the actual number of hours he spent on the job, increased by the overhead percentage made on the job—that is to say, the total bonus hours

earned are divided amongst all the men on the job, in proportion to the number of hours each spent on the job.

One thing which Premium Bonus has demonstrated is the great desirability of keeping down the numbers in the squads, and the scope of the job itself to the absolute minimum, if the best results are to be obtained. This can only be done by splitting up the gang job into the largest possible number of clearly definable elements, and setting a separate time for each. It is a great mistake in squad work, or in fact in individual work, to make a Time Allowance include a larger number and variety of operations than are necessary. There is certainly a great temptation to adopt this method, and it is a very convenient way of balancing up matters, by putting an underestimated job against an over-estimated one, but the initial trouble of dividing up a job into the desired number of small items, and making a detailed analysis and time allowance for each, will be amply repaid by the better results and smoother running which will follow.

The difficulty of getting every man in a squad to work up to his best standard is well-known, and the greater the numbers in the squad the more pronounced is this feature. It is also the case that the longer the period over which the job extends, and the more distant is the reward, the less satisfactory are the results, because of the evaporation of interest or sustained effort which always takes place in a long drawn-out job. Because of these reasons, and the greater liability to unforeseen and unavoidable delays, outside fitting-out work on board ship does not give the same results as inside shop work, all of which goes to show that the more closely and quickly reward can be connected with effort, the better it is for both the man and his employer.

There is no doubt in my own mind that Premium Bonus has a stimulating and elevating effect upon the workmen themselves, for after a time, when they get into the swing of it, they begin to take an interest in working up towards their own best records, and under a progressive management taking a sympathetic interest in their individual efforts, which can be quite easily done, they begin to look upon the work of their hands as something more than a means of marking time for so many hours per day, for which a fixed and

TABLE 14.

Description of Work.	Same Machines throughout.			
	(1) Time taken under old Time System.	(2) Time taken on introduction of Premium System.	(3) Time taken in better location with greater facilities.	(4) Record time for the same job.
	hours.	hours.	hours.	hours.
1. Turning conn. rod. 1 off, -	43½	36	35	29½
2. Slotting conn. rods. 3 off, -	31	24½	22½	20
3. Crank webs (finishing holes, 1 off),	7½	5½	4½	3½
	Old Machines under		New and more powerful Machines (on Premium system).	
	Old Time System.	Premium System.	First time on new Machine.	Record Time.
	hours.	hours.	hours.	hours.
4. Turning tunnel shafting. 1 off.	42	29½	23½	21
5. Turning ecc. rods. 1 off, -	22	11½	9	8½
6. Turning thrust shaft. 1 off,	129	97½	75	65
7. Finish turning crank shaft. 1 off, -	42	34	15	9½
8. Turning quad. blocks. 13 off.	195	140	91½	—
9. Slotting sole-plates. 1 off, -	70	59½	41½	35½
10. Slotting condenser. 1 off,	64	56	44	34
11. Slotting H.P. cylinder. 1 off.	45½	33½	24	21
12. Ripping out holes in crank webs (1 web). 2 holes, - -	29	17	9	7
13. Hole - boring main bearing covers for bolts. 12 holes - -	45	37	27½	20
14. Planing six steel slabs for 12 crank webs,	142½	102	65½	—

unvarying sum is paid. The money reward itself is no small inducement, and the mere fact that the fixing of the amount of such reward is to a large extent in his own hands, and is according to what he gives in return, namely, increased output, makes the workman take a keener interest in his own ability and capacity, and creates a desire to make the best use of these which cannot but have, and, as I know, does have, a broadening influence for good upon himself.

Premium Bonus, in common with all systems of Payment by Results, where such are based upon normal and not extravagant Time Allowances, relieves the foremen and shop managers of that unpleasant duty which, under Time conditions, has always to be exercised, viz., constant watchfulness to see that certain men keep up to their work, and do not fritter away their time. Under the stimulus of a bonus reward, this duty is shifted to the workmen themselves, leaving the foreman free to devote all his time to his legitimate duties, not the least part of which is the scheming and arranging of his work, so that his men can make the best out of their Time Allowances. The steadying effect which this has upon labour costs has to be experienced to be appreciated, but it is undoubtedly a very important influence.

But, of course, all these benefits depend entirely upon the correctness of the original Time Allowances. It cannot be too strongly emphasized that the basis of these must, and can only be, the Times which were taken under ordinary Time rate conditions, and no effort should be spared to bring this home to employers and workmen alike.

Chapter X

HINTS ON PRACTICAL APPLICATION

In the foregoing pages, the main principles of the Rowan System have been fully explained and discussed; but, for the use of firms who contemplate introducing this system into their works, a few hints regarding the practical details of organization and methods may be of assistance.

A good many people have the idea that the system is complex in its methods and cumbersome in its working.

This is by no means the case—there is no difficulty in getting the men to understand the process of assessing the bonus; but, as a short and handy definition as to how the premiums are calculated, the following explanation is given:—

If a man saves $\frac{1}{10}$ of the time allowed, he is paid time and tenth for the hours worked.

If he saves $\frac{1}{4}$ of the time allowed, he is paid time and quarter for the hours worked.

If he saves $\frac{1}{2}$ of the time allowed, he is paid time and half for the hours worked.

And so on for any proportion of time saved. The following is an easy method of calculating premium:—

Multiply the time taken by the time saved, and divide by the time allowed. The answer is premium in hours. (See Table 2, page 20.)

It will be advisable to set down on record the conditions upon which the scheme is based and on which it is to be operated; and, as a guide, I give below a copy of those which we prepared when we introduced our system twenty years ago, and which have stood without alteration ever since.

ROWAN PREMIUM BONUS SYSTEM OF REMUNERATING LABOUR

Memorandum of Arrangement made by David Rowan & Co.,
with their Engine Shop Workmen, on 2nd February, 1898,
the day on which the men returned to work after the
Strike of 1897-1898

1. The time allowed for any job will be fixed by the Management, and will be, as near as can be ascertained, the time which should be taken to the job, when working on time.
2. The time allowed will include all the time necessary to procure tools, set up machine, and obtain material for doing the job.
3. For calculating the premium, the time taken on a job will include all working hours between the starting time of the job and the starting time of the next job.
4. A time allowance, after it has been established, will only be changed if the method or means of manufacture are changed.
5. The hourly rate of wages will, in all cases, be paid for the hours worked. If a man takes longer to do a job than the time allowed, this will in no way affect the premium which he may have made or may make on any other job.
6. Overtime, nightshift, and other allowances will be paid to the men on the same conditions as already prevail.
7. If an article turns out defective while being machined and is condemned, due to a flaw in the material, the workman will receive no premium on that article (of course, he gets his time wages), but if he has several articles on the one "Line," and one of them is condemned, due to a flaw in the material, he will still get the premium, if earned, on the rest of the articles.
8. If a man's workmanship, when finished, does not pass inspection, he will receive no premium for that article, unless he can make the work good within the time allowed, in which case he will still receive any premium earned.
9. In cases of dispute, the matter will be referred to the management, whose decision shall be final.

TABLE 15—*Continued.*

10. Each workman after starting a job will receive a " Job Ticket " or " Line " on which he will find a description of his job, the time when started, and the time allowed. When the job is finished, he will return his " Line " to his foreman, who, if satisfied with the work, will initial and write on it the time when finished, which will be the starting time of the man's next job.

11. In the case of a job requiring the services of a squad of men, a time allowance will be fixed for the complete job. If the total time taken by the squad is less than the time allowed, a premium will be paid to each man in the squad. This premium will have the same relation to his time wages for the job as the time saved by the squad will have to the time allowed.

12. Fitting-Shop Apprentices in their first year are considered Boys and one-third of the time they spend on a job will be calculated against it for premium. The percentage thus found will be paid on the whole time which they spend on a job. Those in their second and third year will be considered Junior Apprentices, and one-half of the time they spend on a job will be calculated against it for premium. The percentage thus found will be paid on the whole time which they spend on the job.

Fitting-Shop Apprentices in their fourth and fifth year will be considered Senior Apprentices, and three-quarters of the time spent by them on a job will be calculated against it for premium. The percentage thus found will be paid on the whole time which they spend on the job.

13. Apprentices at machines will be allowed 25 per cent. more time on a job than a journeyman.

In dealing with the Fitter Apprentices, it will be observed from paragraph 12 above that these are graded into three classes—" Boys," " Junior Apprentices," and " Senior Apprentices," and, instead of varying the Time Allowances to suit each of these grades, the Times Taken by them are modified for Bonus computation.

For example, a certain job has for its Standard Time Allowance 16 hours, to which a Boy takes, say, 24 hours. One-third of this, or 8 hours, is taken as the basis for calculating his Premium—he is, in fact, supposed to have done the job in 8 hours—in which case his percentage of Time Saved would be—

$$\frac{\text{Time Allowed} - \text{supposed Time Taken}}{\text{Time Allowed}} = \frac{16 \text{ hours} - 8 \text{ hours}}{16 \text{ hours}} = 50\%$$

That is, he would be paid 50% bonus on the 24 hours he actually took, and the amount of his bonus will be = $\cdot 5 \times 24 \text{ hours} = 12 \text{ hours}$.

A Junior Apprentice on the same 16 hours' job does it in, say, 20 hours. One-half of this, or 10 hours, is the basis for calculating his premium. The rate of premium in this case will be—

$$\frac{\text{Time Allowed, 16 hours} - \text{supposed Time Taken, 10 hours}}{\text{Time Allowed, 16 hours}} = \frac{16 - 10}{16} = \frac{6}{16} = 37\cdot 5\%, \text{ and he would be paid } 37\cdot 5\% \text{ on } 20 \text{ hours, the time he actually took. The amount of his bonus will be } = \cdot 375 \times 20 \text{ hours} = 7\frac{1}{2} \text{ hours.}$$

A Senior Apprentice on the same 16 hours' job does it in, say, 16 hours. Three-fourths of this, or 12 hours, is the basis for calculating his premium.

$$\text{The rate of premium will be } \frac{16 \text{ hours} - 12 \text{ hours}}{16} = \frac{4}{16} = 25\%.$$

The amount of his bonus will be = $\cdot 25 \times 16 \text{ hours} = 4 \text{ hours}$.

Each of these Apprentices is, of course, always paid for the whole time he spends on the job, and the bonus hours are added to this time, the total multiplied by his hourly rate being his wages for the job.

The reason for employing this method is the necessity of maintaining a common Standard Time throughout for Journeymen and Apprentices alike. This permits of the Time Allowed being always the same, irrespective of the proportions of Journeymen and/or each grade of Apprentice who may be employed on the job.

DATA BOOK

TABLE 16.

STANDARD TIME ALLOWANCES.										Record of Performances.								
CYLINDER L. P. Cylinders with separate Plugs for Stuffing Boxes. OPERATION. Boring out, facing for cover, boring and facing for Stuffing Box. MACHINE No. 183. Horizontal Cylinder Borer (14" bar).																		
M. E. No.	Diam. of Cyl.	Stroke.	D. of Shaft.	Time Allowed.	Time Taken.	Contract No.	No. of Pieces.	Time Allowed.	Time Taken.	Details of Operation.	Class Mark.	Operator.	Machine No.	Date Finished.				
53	48"	33"	9 1/2"	40	23	502	1	60	30	L. P. Cylinder, bore out, etc.,	III	A	183	18-1-09				
56	50"	33"	9 3/4"	40	23	505	1	40	27	Do.	II	A	183	26-1-09				
61 1/2	51"	36"	10 3/8"	40	23	546-7	1	80	47 1/2	Do.	II	A	183	20-1-11				
64 1/2	57"	39"	11 3/8"	40	25	556-7	1	70	38 1/2	Conical	II	A	183	31-5-11				
66 1/2	59"	48"	12 1/2"	44	25	556-7	1	70	40 1/2	Do.	II	A	183	12-7-11				
68	65"	42"	12 1/2"	44	27	567	1	80	64	Do.	II	A	183	23-9-11				
72	67-68"	45"	13 1/2"	50	29	569	1	50	36	Do.	II	B	183	19-10-11				
72a	68"	48"	13 3/8"	60	29	592	1	50	27	Do.	II	B	183	4-11-12				
77	70"	48"	13 3/8"	60	30	595	1	80	40 1/2	Do.	III	B	183	19-12-12				
80	73"	48"	14 1/2"	60	33	630	1	50	34	Do.	II	B	183	23-6-14				
80a	73"	51"	14 1/2"	60	33	627-8	1	50	24 1/2	Do.	III	B	183	14-10-14				
83	73"	48"	14 1/2"	60	33	668	2	140	71 1/2	Do.	III	B	183	14-12-15				
84 1/2	73"	48"	14 3/8"	60	33	650	1	70	35 1/2	Do.	III	B	183	22-5-16				
84 3/4	75"	51"	14 3/8"	60	33					Do.								
Cylinders with Conical Bottoms.																		
86 1/2	78"	54"	15 1/2"	70	45													
148	76"	51"	15 1/2"	70	45													
92	82"	60"	16 1/2"	80	55													

As regards the operations themselves, it will be obvious to everyone that these should be as detailed and as clearly defined as possible. One of the most important duties of the Rate Fixing Department will be the compilation of accurate and reliable data in a suitable shape, which cannot be obtained if Time Allowances are set to contain more than one clearly defined operation. For example, the total Time Taken to all the operations required for the complete machining of, say, a connecting rod, is in itself of no great value, but to be of the greatest use should be broken up so as to show the individual Times Taken by the various men and/or machines engaged on the various detailed operations, such as time for turning, times for the different slotting operations, time for boring, and so on.

Operations should be reduced to their elementary form, and individual "Lines" or "Job Tickets" given for each. Dealt with in this way, not only will the recorded data be of some real value, but much better results will be obtained all round.

Data quickly accumulate, and once a fair amount has been obtained, its tabulation should be given some attention. Table 16, which shows the method and style I have found to be most convenient, is given as a suggestion. The example given is a page of our "Data Book" for the cases of L.P. cylinders. Tables of Standard Times should also be compiled for repetition work such as Drilling holes, Tapping holes, Inserting studs, Machining flanges, etc.

On the right-hand are set down, as they arise, the results of the boring out of various sized L.P. cylinders—these being entered up from the completed "Job Tickets" or "Lines." The left-hand is a table of Standard Time Allowances and Times Taken, which is compiled from the average results shown in the Record of Performances.

It is a convenient plan to classify all main engine pieces by grading these in accordance with crankshaft diameter, and giving a distinguishing numeral for each standard size of engine. Take Propeller Shaft Liners. One would put the bore of the Liners advancing by inches down the left-hand side, and the length advancing by feet

EXAMPLE OF INDIVIDUAL LINE TABLE 17.

Mach. No.	148				42
Cont. No.	645	Engs.			64

No.	NAME.	Hours Worked.	Prem. Hours.	Total Hours.
70	John Smith,	98½	39½	138
	Turner.			

.....

3 Connecting Rods

.....

(Turning complete).

.....

.....

No. off	3	Time Allowed	165	Hours
Job Started	10.30 a.m.		17/1/17	
Job Finished	5.30 p.m.		29/1/17	
Foreman		Inspector		

along the top. Then, having filled in all the Times Allowed and Taken for Liners previously done, it becomes an easy matter by interpolation to select a Time Allowance for any intermediate size. There are some machines, doing a fairly regular class of work, which lend themselves

to an easy start, and whenever a reasonable amount of data has been obtained, the system can be initiated. The Foreman informs the Rate Fixer that " John Smith's " next job will be the Turning complete of a set of three Connecting Rods, giving him the Contract number of the job. From this the Rate Fixer, who has beside him a set of blue print drawings of the job in question, gets the particular size of the job and its crankshaft diameter, or Standard number. On reference to the Data Book he gets the Standard Time Allowance. This and other necessary particulars he enters upon a " Job Ticket " or " Premium Bonus Line "—a sample of which is shown in full size in Table 17. The counterfoils of these Lines are kept in the Time Office or Rate Fixing Department.

As soon as possible after the job is started, the Rate Fixer hands this Line to the Foreman, who, having satisfied himself that the description of the work to be done is correct, passes it on to John Smith. The latter usually has previous information which allows him to make any arrangements he wishes in the way of preparation for this job, when he comes to start it, and he almost always does this while his previous job is in hand. When John Smith has finished with the job, he hands his Line back to his Foreman, who, having satisfied himself that the job is right, puts the date and hour of finishing on the Line and initials it. The Line is then returned to the Time Office, and completed, by marking on it the actual number of hours during which John Smith was at work on the job as shown by the Time Books. This may be quite different from the actual number of hours made up from the dates of starting and finishing shown on the Line, owing to John Smith working late, losing time in the morning, or other similar reasons. The actual time worked is then compared with the Time Allowed, and the premium earned is calculated. This is quite a simple mechanical operation on the slide rule which anyone can be taught in a few minutes. The premium hours are then entered on the Premium Line.

It is to be carefully noted that this date of finishing is the starting date which is put on the new Line for John Smith's next job. By this provision, there is no standing time between jobs, and for this reason the Time Allowance always covers this. The premium hours are entered from the Premium Line into the Wages Book,

TABLE 18.

30th January, 1917

CLASS

Turners

PAY ENDING

No.	NAME	TIME							Total Time	Rate	Amount Earned			Deduct			Total Wages Paid		
		24 th	25 th	26 th	27 th	28 th	29 th	30 th			£	s.	d.	Infirm.	Health.	Unempl.	£	s.	d.
		W.	Th.	F.	S.	M.	Tu.												
70	John Smith		1 $\frac{1}{2}$			1 $\frac{1}{2}$				11.5									
	Overtime,		4				4		3 $\frac{1}{2}$			3	4						
	Daily Total,	9 $\frac{3}{4}$	13 $\frac{1}{2}$	9 $\frac{3}{4}$	5 $\frac{1}{4}$	9 $\frac{1}{4}$	13 $\frac{1}{2}$	6 $\frac{1}{4}$			2	18	8	1	4	3			
	Premium,					39 $\frac{1}{2}$		39 $\frac{1}{2}$			1	17	10						
	Money All'ce.,																4	19	2
71	Robert Brown		1 $\frac{1}{2}$			3				11.25									
	Lost Time,																		
	Overtime,		4		4		4		4 $\frac{1}{2}$			4							
	Daily Total,	9 $\frac{3}{4}$	13 $\frac{1}{4}$	9 $\frac{3}{4}$	9 $\frac{1}{4}$	6 $\frac{3}{4}$	13 $\frac{1}{4}$	6 $\frac{1}{2}$			2	18	7	1	4	3			
	Premium,			12			16	28			1	6	3						
	Money All'ce.,																4	8	2

as shown in Table 18. This is done for each job which the workman completes during the pay week. These premium hours earned during the week are then added up and extended at the same rate as the workman's ordinary time.

While it is desirable to finish an operation once started, this is not always possible, but when a job has to be stopped, the Line is marked " Off Job " by the foreman, who writes on it the date and time of stopping, and hands the Line into the Time Office, and gets a new Line for the new job. When the old job is resumed, the same Line which was stopped is re-issued from the Time Office with the date of restarting marked on it.

The interrupting job is, of course, very properly debited with all the time which elapses between the date at which the workman started to dismantle his old job, and the date at which the old job was back again at the machine and the workman ready to resume the operation at the exact stage where he left it off. This time has, therefore, to be accounted for in some way, and is naturally charged against the cause of its origin. Theoretically, the Standard Time Allowance for the interrupted job should be increased by an allowance for the extra time involved in dismantling and resetting the old job, which extra time would not have arisen but for the interruption. When cases such as these occur, which is very seldom in any shop not engaged in repair work, previous arrangements can usually be made to reduce the extra time involved to a negligible quantity, and no allowance is made. But where the time involved assumes appreciable dimensions, a separate Line is issued for the dismantling and resetting, which is treated as a separate job.

" Job Tickets " or " Lines " for a squad are much the same as those for individuals—Table 19 shows a " Fitting Shop Line." It is not necessary that the different men on the Line start or stop at the same date, but the starting and stopping dates of each man must be carefully noted—this may be written on the back of the Line. If it is a big job, with a large squad of men, it is necessary to use a book for this purpose. The Line issued to the squad in such a case contains only a note of the Job and the Time Allowance.

The first thing a firm ought to do is to appoint a Rate Fixer. Rate fixing is a duty which should on no account be put into the

EXAMPLE OF SQUAD LINE

TABLE 19.

Cont. No. 645

$$\frac{41}{84}$$

No.	NAME.	Grade.	Hours Worked.	% Hours.	Prem. Hours.	Total Hours.
396	Brown,	Jour.	35	35	14	49
401	Smith,	Do.	35	35	14	49
782	White,	Boy	15	5	6	21
602	Black,	Jun. App.	18	9	7½	25½
624	Green,	Sen. , ,	24	18	9½	33½
				102		

Engines.

Fitting Bushes to connecting rods,

Dressing off and fitting together

complete ready for going in place.

No. off. 3 Time allowed 170 Hours.

Job Started 6.0 a.m. 5/2/17

Job Finished 12.30 p.m. 8/2/17

Foreman Inspector

hands of the Foremen themselves—they have, or ought to have, quite enough to do in their ordinary course of duty without having this additional work thrust upon them. The clerical work itself is sufficiently great to make it highly undesirable thus to waste any foreman's time in dealing with it, and for various obvious reasons it

is better that the work involved in compiling and analyzing data and settling Time Allowances should be in the hands of an official in a more or less judicial position.

The Rate Fixer should, therefore, be as good a man as possible, for in the course of time, as the system grows and spreads to other departments, he will naturally have to organize his own to keep pace with the requirements, and will ultimately become a very responsible official. He should, therefore, command and merit the respect of the entire management and the workmen themselves, and should possess a large share of tact and discretion. He must, of course, be a trained engineer, with as intimate a knowledge of shop conditions and practice as possible. He will, in any case, soon acquire this, if he is wise enough to walk warily at first. In course of time, he will require one or more assistants, who should be tradesmen with a good knowledge of drawings, a fair education, and character and ability to gain the respect and confidence of the workmen. There are many such amongst the workmen themselves, and the Rate Fixing Department will form a most useful training and recruiting ground for assistant foremen.

The Rate Fixing Department, being in such intimate connection with the Foremen and Timekeepers, will make it their business to carry these along with them, by consulting and collaborating with them when occasion requires. In all likelihood, the Rate Fixing and Timekeeping Departments will ultimately merge into one.

No firm need be deterred by the apparent additional cost to their standing charges, which the creation of this new department may involve. If it and the system are efficiently organized, and properly and sympathetically worked, the trouble and extra expenditure will be amply repaid by the results obtained, and by the finer spirit and atmosphere created throughout the whole establishment.

But, at the outset, it must not be left to run or create itself. One of the Principals of the firm must make it his business to take a keen and daily interest in what is being proposed and done. If he is convinced of the merits of the system, he will allow no difficulty to stand in the way, and will see to it that the system is honestly and impartially administered—every complaint investigated and put right at once—

Chapter XI

CONCLUSION

Increased output we must have—we cannot shut our eyes to this fact—if our nation is to survive the upheaval of this terrible war, and be able to take her place, fully armed and equipped, for the industrial and economic conflict which will follow, but we must see that it is obtained in a proper and legitimate manner and by methods which will stand the test of time.

On the one hand, both employers and workmen, whether they like it or not, must apply their minds to this fact, that in the future they will have to give better value for the same money than they have done in the past, or the same value for less money. On the other hand, the demands of labour for increased wages to meet the ever rising standard of living have to be recognised and met in some form or other. These are two conflicting conditions which must be reconciled, and one of the great problems before us is how this is to be done.

Higher wages to workmen may be obtained by a raid on the profits of the capitalist, and this is a favourite hunting ground for doctrinaire and socialistic writers on industrial betterment; but any impartial investigator, who has given a little time to a serious consideration of the average profits obtainable in the shipbuilding and engineering industries during the last ten or fifteen years, will very soon come to the conclusion that no permanent increase in the workmen's wages can be reckoned on from this source. He will find, according to Mr. Gerald Stoney in his Presidential Address to Section D of the British Association last year, that the capital employed in the engineering trade averaged £200 per individual employed, and that the dividends paid averaged 4%—or £8 for every £200 of capital. Therefore, if these dividends were entirely handed over to the employees concerned, their increase of wages from that

source would be only about £8 per head per annum. These average dividends, measured by any standard, cannot be termed excessive; and it will be evident that they are already at a point at which any further reduction will, in time, result in a diversion of the capital employed in this industry into other and more remunerative channels, and in a decay of the industry, from which result the workmen themselves will be amongst the first to suffer. Increase of earnings must, therefore, be sought for in some other direction, and by some other method, than the despoiling of the capitalist.

I submit that the method to be adopted is the universal adoption of a System of Payment by Results, and Premium Bonus in particular. Through it, the men have in their own hands a method of increasing to any reasonable extent the value of their rate of output, and of increasing their wages by a sum much in excess of anything they would get by any possible absorption of the profits of capital. I have shown that, under a properly worked system of Premium Bonus, the percentage of increase in the man's usual time wages may be anything up to 50% or even 60%. If we take the normal Time wages of skilled men at £2 per 54 hours' week—say £100 per year—it is a very indifferent worker who, under Premium Bonus, does not make all the year round at least 10% on this—or £10 per annum, and the good man will, as I have shown, make a steady 50%, or £50 per annum, over his Time wages. If the workman's skill and ability are his capital, surely a scheme which enables him to make an annual dividend or profit from 10% to 50%, instead of the 5% to 7½% or even 10% of the capitalist, is one which should not be lightly set aside.

Premium Bonus is in fact the best practical form of co-partnery which the workmen could have. It gives them a direct and immediate return on their efforts—they do not have to wait for six months or a year for their dividend or profit—it is paid at the end of each week—each receiving an amount in direct proportion to the degree in which he has merited or worked for it. There are no such things as losses to be considered in *their* annual balance sheet.

But all this cannot be obtained without increased output on the part of the workmen themselves, and I shall have fallen very far

short indeed of my intentions, if anything I have said in the foregoing pages should convey the impression that I am in any way seeking to impose upon them a system which would reduce them to the level of human automatic machines, or which would undermine or detract from their individuality. I have in fact quite clearly indicated the contrary in more than one passage. Vitally important as increased output is, it is not everything^a—after all we do not live to work, we work to live, and from every point of view increased output will be of little use to this country if it can only be purchased at the expense of lowering the standard of domestic, social, or national ideals; or depriving our workmen of the time or energy to enable them to fulfil their duty as men and citizens.

If the claims of the industrial workers of this country for shorter hours of labour and greater leisure are to be given effect to, whether that be for the purpose of cultivating the intellectual side of their being, or merely providing more time for amusement, one thing is quite certain, that this will never become a practical possibility, unless there is brought into operation a rate of output very considerably in excess of what has been the rule in the past.

The very greatest disservice which workmen can do themselves, not to say their country, is to continue to countenance the “ca’ canny” principle which has been such a disappointing feature in the past; and if they can but bring themselves to cast aside the shackles of their past conservatism—to realise and believe that the Premium Bonus System is not a trap to ensnare them into giving something for nothing, but is, when honestly worked and properly administered, a real and practical means of, not only directly increasing their earnings to a most satisfactory extent, but indirectly solving a large number of the minor disputes and differences which give rise to so much unnecessary and quite avoidable friction,—they will have done themselves and their country no small service.

I speak with knowledge and conviction arising from twenty years’ experience of the satisfactory operation of the Rowan System in my own shops; and, in support of this, I may quote the view of one of our principal and most highly respected Trades Union officials on the Clyde, openly and formally expressed to me in presence of one of his own District Committees and several other members at a Conference

on the subject in connection with another firm, some six months ago. He stated—"It is well-known, and I am not giving away any secrets " when I say, that so satisfactory, from the men's point of view, was " the working of the Rowan System in Rowan's shops, that nothing " our Union could do would ever eradicate it from this shop." I submit that a certificate of character of that kind from such a source, and at such a time as this, speaks volumes for the Rowan System from the men's standpoint.

Apart from the benefits to the workman, I have already indicated how satisfactory it can be made from the employers' point of view, and I can assure any employer who introduces and honestly and sympathetically operates it, and who wholeheartedly determines to make it a success, that he will never have cause to regret having done so. But, of course, it requires to be worked fairly and tactfully in no narrow or selfish manner, and with a due regard to the fact that the employer is dealing with men and not with machines.

The system undoubtedly puts a much more severe tax upon the management than upon the men, and calls up the exercise of many qualities—discretion, tact, and sympathy—to mention only a few. The sooner employers as a body realise that, in their department of management and administration, there is quite as much room for improvement as exists amongst the rank and file who man their workshops—the sooner the Unions and their members realise that they, as well as the employers, have national duties as well as individual privileges, and lay aside a large part of their distrust of the employer and his motives, the sooner both sides realise that neither party possesses a monopoly of all the virtues or all the vices, and set their minds to put their respective houses in order—the sooner will this burning question of increased output and greater efficiency be viewed from the correct standpoint, and properly dealt with.

I believe that our British workman properly led, and sympathetically handled, has within him the capacity and ability to become the greatest producer in the world, and, if a means can be found to give effect to that ability, then we need fear no foreign competition whatever.

I believe that in the Premium Bonus System we have a most effective, handy, and practical means of bringing about that result, in a manner satisfactory to the nation as regards output, to the employer as regards reduced labour cost, and to the workman as regards increased wages. A method such as this which can help so much to meet the aspirations and go so far in co-ordinating the hitherto opposing interests and efforts of capital and labour, is deserving of a more considered and impartial investigation than has, so far, been accorded to it.

I believe that at heart the great body of our workmen is sound, and that underlying the layer of materialism arising from many years of peaceful prosperity, we as a nation have within us those racial characteristics upon which alone true greatness can be built. The grim lessons and experiences of this terrible war, which are slowly but surely being driven home upon us, are evidently the only means by which we can be purged of those grosser elements which prevent the real strength of our national character from appearing—they are, I humbly believe, the means which Providence is using to prepare us to fill that high destiny and position amongst the nations of the world which are in store for our beloved country, a position of greater splendour and prosperity than has ever been known in the history of the world.

That being so, let each one of us see to it that we do what we can to forward such a high ideal. Let our employers and workmen alike cast aside that parochial and selfishly narrow outlook which has been such a stumbling block in the past, and by a lesser suspicion of each other's motives, and a greater appreciation of each other's rights and obligations, sink such differences as they may have in a whole-hearted desire to thoroughly equip themselves for the coming economic battle for industrial supremacy. If they do so, then we shall be able at once to put our country back again into the great industrial position amongst the nations which she once occupied and should never have lost.

APPENDIX

THE ROWAN GENERAL SYSTEM

The following Appendix has been written for those who may desire to go more fully into the subject, and in order to indicate how the Rowan Premium Bonus System of Payment by Results may be adapted to suit the circumstances and conditions of any particular industry, however widely they may differ from those pertaining to Marine Engineering, for which the Rowan System was originated; and that, without in any way conflicting with the general principle underlying the System itself, or the method of dealing with the Bonus.

What is commonly known as "The Rowan System" is in reality only one special case in a series of an infinite number of possible variations, all of which possess the same characteristics.

The Rowan Bonus Formula as usually expressed is:—

$$\frac{\text{Time Taken} \times \text{Time Saved}}{\text{Time Allowed}} = \text{Bonus in Hours}$$

and, as the Time Allowed = Time Taken + Time Saved, then this may be expressed as:—

$$\frac{\text{Time Taken} \times \text{Time Saved}}{\text{Time Taken} + \text{Time Saved}} = \text{Bonus in Hours or } B = \frac{T \times S}{T + S}$$

Where T = Time Taken, S = Time Saved, A = Time Allowed and B = Bonus in hours.

Expressed in the more general form

$$B = \frac{(K) T \times S}{(K) T + S} \dots\dots\dots(1).$$

where K is a numerical factor which may have any positive value. (In the usual Rowan Formula K = 1).

Where K is fixed, B will vary with different values of T and S, becoming a maximum when $\frac{S^2}{T^2} = K$ (see Note 1, page 95)(2).

$$\text{i.e., when } S = \frac{A \sqrt{K}}{1 + \sqrt{K}} \text{ (see Note 1, page 96) (3).}$$

$$\text{and } T = \frac{A}{1 + \sqrt{K}} \quad \text{''} \quad \text{''} \quad (4).$$

$$\text{and the value of this maximum is } B = \frac{S^2}{A} \quad \text{''} \quad \text{''} \quad (5).$$

$$\text{or } = \frac{A K}{(1 + \sqrt{K})^2} \quad \text{''} \quad \text{''} \quad (6).$$

It is obvious that, by varying K, there can be any number of Bonus curves, all having the same characteristics, namely, zero limits and a maximum value, but each having its maximum located at a different point on the scale of saving, and of a correspondingly different value.

The question whether, under a proper Time Allowance or a Piece price built upon same, a workman is or is not entitled to make double wages is a debatable one. I maintain, on national economic grounds, he is not, and certainly the System as already established has by experience proved its efficiency and reasonableness in the Engineering Trades—but that is not the point.

If it be considered permissible or expedient that, under certain circumstances, the total earnings should be equal to double wages, at the Standard Time rate, then the stage of saving in time at which this condition is reached should be a very high one indeed.

In considering this proposition, it is necessary to take up in turn certain conditions which are related and interdependent, and show how an alteration in one involves a change in the value of the others.

These conditions are:—

- (1) The amount of Maximum Bonus and its position in the scale of saving.
- (2) The limit to the increase on the Time rate of wages.
- (3) The stage of saving at which double wages, measured by the Standard Time rate, may be made.

(1) Maximum Bonus

(See Note 1, page 95)

Under the Rowan System as now worked, the amount of the Bonus which is zero when no saving is made, rises to a maximum at 50% saving of time, and thereafter decreases, becoming zero when no time is spent on the job. (See Table 6, page 25.)

It is urged that, as the actual amount of the Bonus itself decreases after the 50% saving point has been passed, the inducement to the

workman to exceed this point is not sufficiently active, as the reward for such higher rates of saving is in itself not commensurate with the additional effort required. Expressed in another form, this means that the point of Maximum Bonus should be further up the scale of saving.

This argument, which has already been dealt with in Chap. IV., p.28, ignores altogether the element of Time, and its strength depends on the correctness of the assumption that it is reasonable to expect savings exceeding 50%. I have maintained that, as far as general engineering is concerned, it is not, but, at the same time, I am quite ready to admit that there are certain repetition trades in which gradually acquired manual dexterity may ultimately lead to savings in excess of 50%, without putting any additional stress upon the workman himself.

In all cases, it is certainly desirable that the Maximum Bonus point should be at that stage of the saving which it is possible and reasonable to expect the workman to reach without having to overtax himself in attaining it, and that there be no special inducement to exceed this point. *quite*

The question would, therefore, appear to depend upon where the exact point of the maximum saving in any particular case should lie. If this can be decided, then, under the Rowan System, means can be provided to suit this particular case, by selecting a suitable value for a certain factor in the Rowan Bonus Formula, which can be adapted to make the point of Maximum Bonus coincide with any desired value of the percentage of time saved, so that, instead of having the maximum occur when a saving of 50% of the Time Allowed is effected, it can be made to take place when the Time Saved is 60%, 70%, or 80% of the Time Allowed, or any other value above or below 50%.

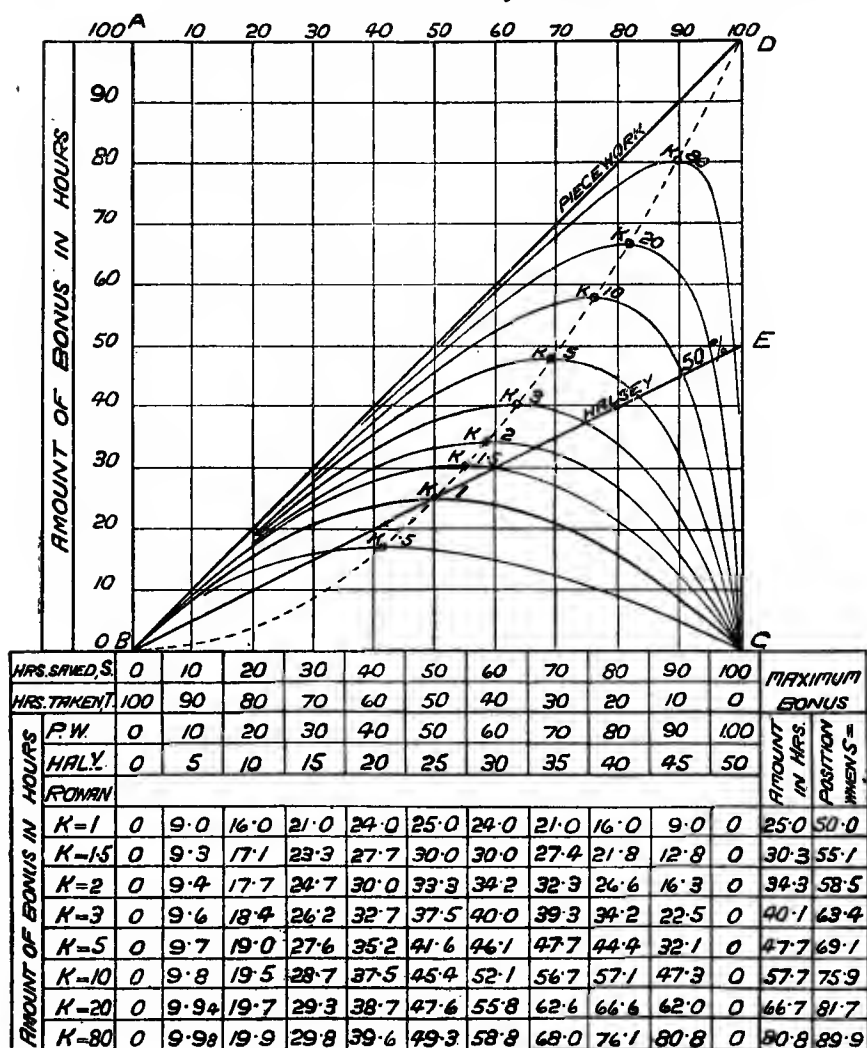
In Table 20 is set out a series of these curves for different values of K—marked K_1 , $K_{1.5}$, K_2 , K_3 , etc., and in the tabular statement at the foot, for a 100 hours' Time Allowance, are given, for each value of K and various values of Time Saved, the numerical values of B, also their maximum values, and the exact point of the Time Saved at which these maximum values occur. Where the curve B K D intersects

TABLE 20

AMOUNT OF BONUS

COMPARISON OF ROWAN GENERAL SYSTEM
WITH HALSEY AND PIECEWORK

T = Time Taken S = Time Saved A = Time Allowed K = A Factor

ROWAN GENERAL SYSTEM $B = \frac{KT \times S}{KT + S} = \text{Curves B K C}$ HALSEY SYSTEM - $B = \frac{A - T}{2} = \text{St. line B E}$ PIECEWORK SYSTEM - - $B = \frac{\text{Piece Price}}{\text{Hourly Time Rate}} - T = \text{St. line B D}$ 

Curves are plotted to two places of decimals and, for clearness, numerical values are restricted to one.

the various Bonus curves K_1 , $K_{1.5}$, K_2 , K_3 , etc., these are the points of Maximum Bonus where $K = 1, 1.5, 2, 3$, etc., as the case may be, in the general formula for B. (See Note 2.)

The point of Maximum Bonus may accordingly be fixed at any desired stage in the scale of saving, but when fixed, it at once determines the amount of that Maximum Bonus and the value of K which has to be used in the Bonus formula.

For comparison, the Halsey and Piecework Bonus lines B E and B D are shown, and it will be noted how closely with the higher values of K the Rowan Bonus curves approach the Piecework Bonus line in the earlier stages of the Time Saved.

The total cost of the job in hours is the Time Taken, plus the Bonus earned or $T + B$, and in Table 21 are set out the corresponding Rowan curves of hours' cost, K_1 , $K_{1.5}$, K_2 , K_3 , etc., along with their numerical values for each value of K —also the Halsey and Piecework hours' cost lines A E and A D.

(2) Limit of Increase on Time Rate

If the Total Hours' Cost be divided by the Time Taken, we get the number of times the man's Time rate per hour is increased by the Bonus he earns. Taking his hourly rate on Time as unity, the formula for his increased rate, R , for any given saving of time, S , will be:—

$$R = \frac{\text{Total cost in Hours}}{\text{Time Taken}} = \left(T + \frac{K T \times S}{K T + S} \right) \div T.$$

$$\therefore R = 1 + \frac{K \times S}{K T + S} \dots \dots \dots (7).$$

The theoretical limit of the increased rate per hour R occurs when 100% of the Time Allowed is saved, that is the job done in zero time, in which case $S = 100$ and $T = 0$, and the formula becomes:—

$$R = 1 + \frac{K \times 100}{K \times 0 + 100} = 1 + \frac{100 K}{100} = 1 + K.$$

or $K = R - 1 \dots \dots \dots (8).$

TABLE 21

COST OF JOB

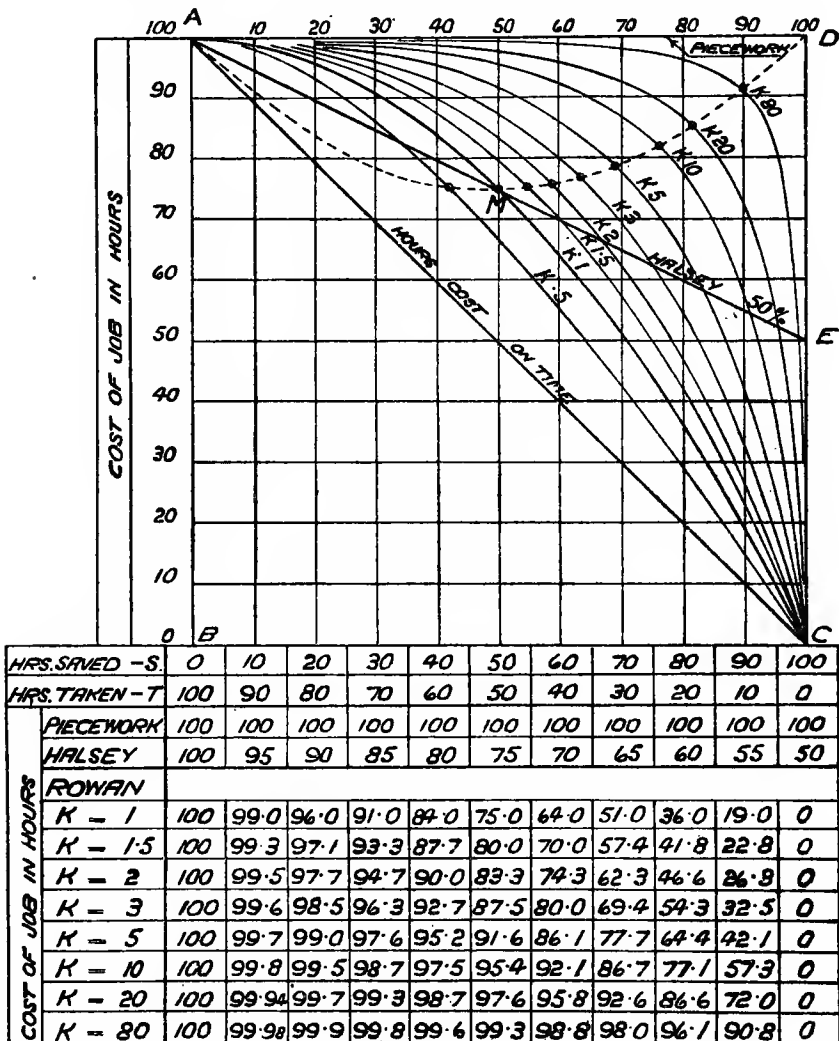
COMPARISON OF ROWAN GENERAL SYSTEM
WITH HALSEY AND PIECEWORK

T = Time Taken S = Time Saved A = Time Allowed K = A Factor

ROWAN GENERAL SYSTEM $C = T + \frac{KT \times S}{KT + S} = \text{Curves A K C}$

HALSEY SYSTEM - - - $C = T + \frac{A - T}{2} = \text{St. line A E}$

PIECEWORK SYSTEM - - $C = \frac{\text{Piece Price}}{\text{Hourly Time Rate}} = \text{St. line A D}$



Curves are plotted to two places of decimals and, for clearness, numerical values are restricted to one.

There is therefore a direct connection between the value of K and the theoretical limit to the increase in the rate per hour. The value of K is 1 in the Rowan System as at present worked, so that R in this case is 2, which is in accordance with what is already known.

Similarly, if $K = 2$ then $R = 3$, $K = 3$ then $R = 4$, and so on.

In Table 22 are shown the variations in R, the workman's rate per hour, arising from different values of K and S, and for comparison the Halsey and Piecework hourly rate curves are shown—the numerical values as before being in the tabular statement below the diagram.

In these three Tables, 20, 21, and 22, the Rowan curve, marked K 1, also the Halsey and Piecework curves, are those which appear in Tables 6-5-7. In Table 22, in order to get the required vertical range for the curves K 2 and K 3, the diagram starts at the 100 line B C instead of zero line as is done in Table 7.

Referring to Table 22, it will be observed that the curves K 1, K1.5, K2, K3, have their limiting points at D, M, H, and L respectively. These are the points at which the rate per hour becomes 2, 2.5, 3, and 4 times the unity rate. The other K curves would likewise vanish on the ordinate C L extended at points whose values are $(K + 1)$, were the diagram large enough to show this, but no diagram could ever be large enough to show the limits of the Halsey and Piecework curves which continually approach the line C L but will never touch it.

(3) Double Wages

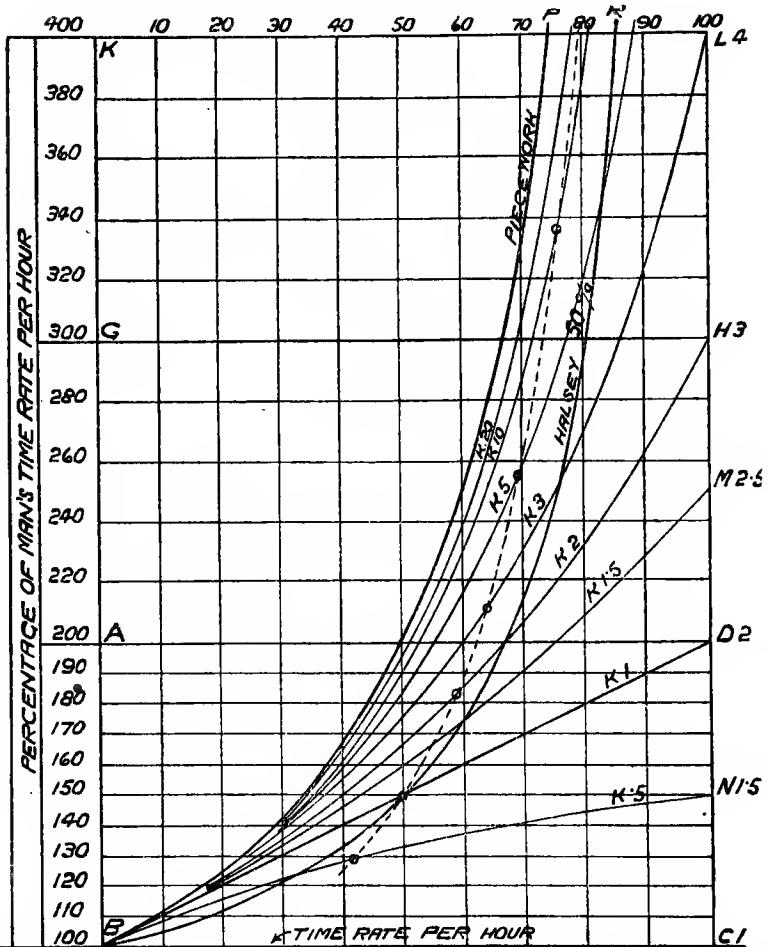
Where the curves K1, K1.5, K2, and K3 cross the line of double wages A D, these points indicate the stages of saving at which double wages would be made under the Bonus Formula in which $K = 1$, 1.5, 2, and 3 respectively. In the case of $K = 3$, this takes place at 60% saving; $K = 2$ at 66.6% saving (which is also the stage of saving under the Halsey System at which double wages are made); $K = 1.5$ at 75%; and $K = 1$, at 100% saving.

There is a definite relation between K and S, the stage at which double wages are made, which is expressed by the formula,

$$K = \frac{S}{S - T} \text{ (see Note 3, page 99) (9).}$$

TABLE 22

INCREASE ON MAN'S TIME RATE
COMPARISON OF ROWAN GENERAL SYSTEM
WITH HALSEY AND PIECEWORK



HRS. SAVED - S.	0	10	20	30	40	50	60	70	80	90	100
HRS. TAKEN - T.	100	90	80	70	60	50	40	30	20	10	0
PIECEWORK	1.0	1.1	1.2	1.4	1.6	2.0	2.5	3.3	5.0	9.0	INFINITY
HALSEY	1.0	1.05	1.1	1.2	1.3	1.5	1.7	2.1	3.0	5.5	INFINITY
ROWAN											
K = 1	1.0	1.10	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
K = 1.5	1.0	1.105	1.21	1.3	1.46	1.6	1.75	1.9	2.0	2.2	2.5
K = 2	1.0	1.105	1.22	1.35	1.5	1.66	1.8	2.0	2.3	2.6	3.0
K = 3	1.0	1.107	1.23	1.37	1.54	1.7	2.0	2.3	2.7	3.2	4.0
K = 5	1.0	1.108	1.238	1.39	1.58	1.8	2.1	2.5	3.2	4.2	6.0
K = 10	1.0	1.109	1.24	1.4	1.6	1.9	2.3	2.8	3.8	5.7	11.0
K = 20	1.0	1.1105	1.246	1.419	1.63	1.95	2.39	3.08	4.3	7.2	21.0
K = 80	1.0	1.1109	1.249	1.426	1.66	1.98	2.47	3.26	4.8	9.0	81.0

Curves are plotted to two places of decimals and, for clearness, numerical values are restricted to one.

If it be desired that double wages be made at any particular stage of saving, S, then from this formula (9) the required value of K may be found by substitution.

Summary

From the foregoing it will be seen that under the Rowan System there are three conditions under which the Bonus allotment may be decided, viz.:—

- (1) Where should the point of Maximum Bonus be on the scale of saving ?
- (2) What should be the theoretical limit to the increase on the hourly time rate ?
- (3) At what stage of the saving may double wages be made ?

These are all interdependent, a decision on any one of these three immediately determines the other two, but whichever condition be selected as a basis, the general Bonus Formula $B = \frac{K T \times S}{K T + S}$ can be adapted to meet this deciding condition, by using in it the value of K derived from the appropriate Formula for same.

These have already been given and are:—

- (1) Having fixed the point of Maximum Bonus, - - - - $K = \frac{S^2}{T^2}$ (see page 85) (2).
- (2) Having decided the theoretical limit to increased rate per hour, R - - $K = R - 1$ (, 89) (8).
- (3) For stage of saving at which double wages are made, - - - - $K = \frac{S}{S - T}$ (, 91) (9).

These then are the three points of view from which the Employer may regard the Rowan System. According to the relative importance, in his view, will depend which of the conditions he decides to take as a basis for his form of the Rowan Premium Bonus.

The system is elastic enough to suit any set of circumstances. While possessing this advantage, the important fact must not be overlooked, that the higher the value of K (necessitated by increasing the value of any one of the above features), the closer and more accurate must be the Time Setting.

While the bonus formula $B = \frac{K T \times S}{K T + S}$ may at first appear formidable, there is no practical difficulty attendant on its use. The Bonus Lines remain the same, and are used exactly as described on pages 72 and 73. In calculating wages, the actual number of hours worked, that is, the Time Taken, is straight away multiplied by K, and thereafter the calculation becomes the same as that for the ordinary Rowan System.

A study and comparison of Tables 20, 21, and 22 will show that the further up the scale of saving we fix the point of Maximum Bonus (which also raises the theoretical limit to the increase in the Standard Time rate of wages, and brings the point of double wages down the scale of saving), the more nearly do Bonus, Hourly Rate, Wages, and Total Hours' Cost approximate Piecework conditions, with all that this involves in loss of elasticity in fixing Time Allowances, by increased penalty for mistakes.

MAXIMUM BONUS—POSITION AND VALUE

Let T = Time Taken S = Time Saved
 B = Bonus in hours K = Numerical Factor
 A = Time Allowed or $A = T + S$

GENERAL BONUS FORMULA

$$B = \frac{KT \times S}{KT + S} \dots\dots\dots(1).$$

Given K to find S and T , so that B may have its maximum value (B Maximum).

$$\text{From (1) } B = \frac{KT \times S}{KT + S} = \frac{KT(A - T)}{KT + A - T} = \frac{KAT - KT^2}{A + KT - T}$$

Differentiate B in terms of T , that is :—

$$\frac{dB}{dT} = \frac{(A + KT - T) \times (KA - 2KT) - (KAT - KT^2) \times (K - 1)}{(A + KT - T)^2}$$

$$\text{For } B \text{ (Maximum) } \frac{dB}{dT} = 0.$$

$$\therefore KA^2 - 2KAT + K^2AT - 2K^2T^2 - KAT + 2KT^2 - K^2AT + KAT + K^2T^2 - KT^2 = 0$$

$$KA^2 - 2KAT - K^2T^2 + KT^2 = 0$$

$$\therefore A^2 - 2AT - KT^2 + T^2 = 0$$

$$\text{or } A^2 - 2AT + T^2 = KT^2$$

$$\therefore \frac{(A - T)^2}{T^2} = K, \text{ but } A - T = S$$

$$\therefore \frac{S^2}{T^2} = K \dots\dots\dots(2).$$

$$\text{or } \frac{S}{T} = \sqrt{K}, \text{ but } T = A - S$$

$$S = \sqrt{K} \times (A - S)$$

$$S = A \sqrt{K} - S \sqrt{K}$$

$$\therefore S (1 + \sqrt{K}) = A \sqrt{K}$$

$$\therefore S = A \times \frac{K}{1 + \sqrt{K}} \dots \dots \dots (3)$$

$$\text{Now } T = \frac{S}{K} \text{ (from (2) above)}$$

$$\therefore T = \frac{A}{1 + \sqrt{K}} \dots \dots \dots (4).$$

The Time Allowed, A, and the factor K being known, the value of S (and therefore T) is thus obtained, which gives the point of Maximum Bonus on the scale of saving.

In the usual Rowan formula $K = 1$, therefore, maximum bonus is earned in that case when $T = S = \frac{A}{2}$.

The value of B (Maximum) can now be found by substituting the values of S and T from (3) and (4) above, in the General Bonus Formula (1), or equally quickly as follows :—

Substitute for K in Bonus Formula (1), the value $\frac{S^2}{T^2}$ from (2),

$$B \text{ (Maximum)} = \frac{\frac{S^2 \times T \times S}{T^2}}{\frac{S^2 \times T + ST^2}{T^2}} = \frac{S^2 \times T \times S}{S^2 \times T + ST^2}$$

$$\text{and } B \text{ (Maximum)} = \frac{S^2}{S + T} \text{ but } S + T = A$$

$$\therefore (B) \text{ Maximum} = \frac{S^2}{A} \dots \dots \dots (5).$$

$$S = A \times \frac{\sqrt{K}}{1 + \sqrt{K}} \quad (\text{from 3})$$

$$\therefore B \text{ (Maximum)} = \frac{S^2}{A} = \left(\frac{A \sqrt{K}}{1 + \sqrt{K}} \right)^2 \times \frac{1}{A}$$

$$\text{which gives } B \text{ (Maximum)} = A \times \frac{K}{(1 + \sqrt{K})^2} \dots \dots \dots (6).$$

It will thus be seen that, for every value of S , a definite value of K can be selected, which will give a system such that B , the bonus in hours, will be a maximum at that point S on the scale of saving.

From (5), it will further be seen that the curve passing through these points of maximum value has as its equation $B = \frac{S^2}{A}$ (see Table 20).

CURVE OF MAXIMUM BONUS POINTS

In Table 20 the curve BKD is the locus of these points of Maximum Bonus, and the equation to this curve is $B = \frac{S^2}{A}$

This curve is interesting as it is an inverted replica of the K1 curve of Total Hours' Cost in Table 21. If the line AD in Table 20 be taken as the base line, then the ordinates dropped from this line to curve BKD are equal in value to the ordinates in Table 21 from the base line BC to the K1 curve at the same values of S. This can be easily shown.

In Table 20 the ordinates from the base line BC to the Maximum Bonus curve BKD are $= \frac{S^2}{A}$ at any point S. If A, the Time Allowed 100 hours is represented by the base line BC. The ordinate AB represents the amount in hours available for Bonus. This can never exceed the Time Allowed, 100 hours, and is the fund out of which alone can Bonus be paid.

A B is therefore = B C and = A.

If at any point S, a Bonus is paid equal in amount to $\frac{S^2}{A}$, then the balance left over must be $A - \frac{S^2}{A}$, but $A - \frac{S^2}{A}$ are the ordinates to the curve BKD referred to the base line AD

$$\begin{aligned} \text{and } A - \frac{S^2}{A} &= \frac{A^2 - S^2}{A} \\ &= \frac{(A + S)(A - S)}{A} \\ &= \frac{(A + S) \times T}{A} \text{ as } (A - S) = T \\ &= \frac{AT + ST}{A} = T + \frac{TS}{A} \end{aligned}$$

which in Table 21 is the equation to the Hours' Cost curve K1 referred to the base line BC.

DOUBLE WAGES—POSITION ON THE SCALE OF SAVING

Double wages are made when—

The Bonus in Hours=Time Taken.

$$\text{That is } B = \frac{KT \times S}{KT + S} = T$$

$$\therefore KT \times S = KT^2 + TS$$

$$\therefore K \times S = KT + S$$

$$\therefore KS - KT = S$$

$$\therefore K(S - T) = S \therefore K = \frac{S}{S - T} \dots\dots\dots(9)$$

As K is always a positive quantity, S must always be greater than T, that is, lie between 50% and 100% of the Time Allowed.

If S = 100, then T = 0

$$\therefore K = \frac{100}{100 - 0} = 1$$

which is its value in the Rowan System as now worked.

*The Most Obvious
Conclusion*

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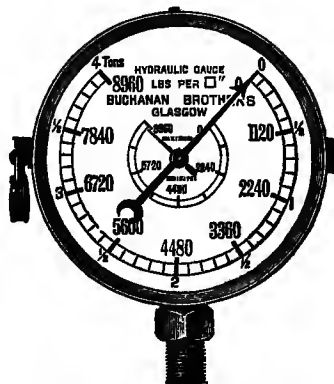
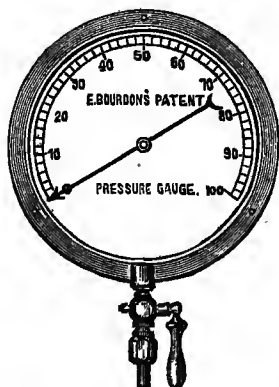
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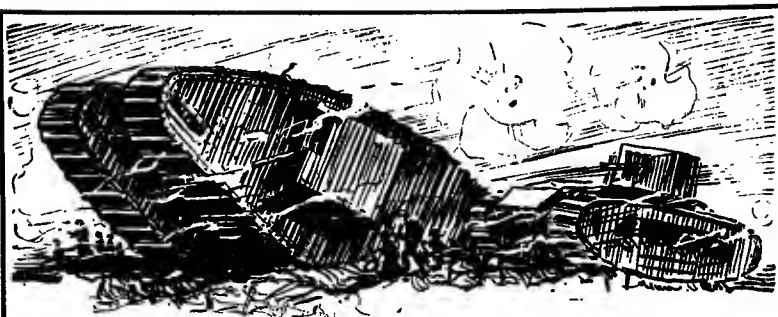
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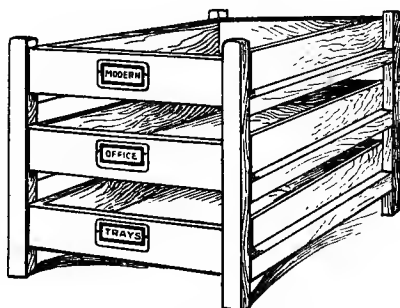
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